

# **ASSESSMENT OF DIGITAL VIDEO RECORDING TECHNOLOGY FOR USE IN IOWA STATE PATROL ENFORCEMENT VEHICLES**

*Prepared and submitted by the Iowa Department of Public Safety  
pursuant to 2007 Iowa Acts, Senate File 575*

## **Statement of Context**

During the 2007 session of the Iowa General Assembly, questions arose relating to in-car video recording technology and associated recording policy and practice among Iowa law enforcement agencies. In an effort to advance awareness and understanding of issues related to in-car video recording technology and its use, the Iowa Department of Public Safety supported the adoption of a study directive for the Department, specific to the Iowa State Patrol.

The study directive was ultimately included as one element of Senate File 575, the Justice System Appropriations Bill. Section 19, SF 575, specified the scope and content of the report, as follows:

“The department of public safety shall study and make recommendations regarding the benefits as well as the disadvantages of converting the recording equipment in the state patrol enforcement motor vehicles to digital camera recording technology for use in such vehicles. The study shall include an estimate of the cost of converting to the technology, an assessment of issues related to data storage and the rules of evidence, implementation concerns, and if a conversion is recommended, a timeline for acquiring and deploying the digital camera recording technology in the motor vehicles of the state patrol.”

Though not explicitly stated in the study directive, one specific concern that was expressed during the 2007 session relates to the issue of the limited capacity of VHS-based analog recording systems, and the inability to capture video when the recording media (usually VHS tape) is full. The question of whether digital recording systems offer advantages over analog systems was raised, as most digital video recording systems do not use magnetic tape, but instead

use solid state memory (flash memory), a hard drive, or DVD recorder. That issue, in addition to other comparisons, will be discussed in this report.

This report is organized into seven sections, plus appendices, as follows:

- I. Background and Current Practice**
- II. Assessment of Digital Recording Technology**
- III. Advantages, Disadvantages, Comparables, and Opportunities for Enhanced Functionality**
- IV. Rules of Evidence**
- V. Implementation Concerns**
- VI. Cost**
- VII. Timeline Considerations**
- Appendices**

## **I. Background and Current Practice**

The first mobile video systems used by the Iowa State Patrol were installed in the early 1990s. During the last one and a half decades of use, the in-car video technology has been demonstrated and proven to be a critical piece of equipment for state troopers. Currently, all enforcement vehicles assigned to ISP troopers and sergeants are equipped with in-car video systems that record video images in color. All systems currently installed and utilized employ analog VHS-based recording technology. The major components of the VHS-based recording system include:

- Single windshield-mounted camera.
- Control head and monitor mounted in close proximity to the driver seat.
- Trunk-mounted vault that contains a video cassette recorder.
- Wireless microphone (worn by the trooper).

The video cassette recorder in the trunk-mounted vault uses standard VHS recording media. ISP uses standard VHS tapes that have the capacity to record six (6) hours of video footage. Video recording is automatically initiated upon engagement of the vehicle's emergency lights.

Additionally, video recording can be manually initiated without the vehicle's emergency lights in operation. Likewise, video recording commenced automatically by activation of the vehicle's emergency lights can be manually overridden to address circumstances where the vehicles emergency lights are engaged for lengthy periods of time, but where no enforcement action, emergency response, or public contact (such as a "motorist assist") is occurring.

The most typical example is a circumstance where an officer leaves emergency lights activated while parked or stopped for an extended period of time to alert approaching motorists of a lane, road, or ramp closure. During a typical eight hour shift, enforcement actions, motorist assists, emergency response, and other actions will result in approximately two hours of video recordings, though any given shift can result in considerably less or more record time.

The technology used by ISP is comparable to video recording systems most commonly used by other state and local law enforcement agencies across the nation, though there are jurisdictions using systems that offer considerably better performance and features, just as there are jurisdictions using systems that offer fewer features and lower performance than the systems used by ISP. It should also be noted that there are many law enforcement agencies that do not utilize in-car video recording technology of any sort. Generally, the smaller law enforcement agencies with the greatest resource limitations are those most likely not to utilize in-car video recording systems.

Though the video recording systems used by ISP all have similar features and performance, there are currently eight different models used by ISP. Over the years, the inconsistent availability of funding has resulted in the procurement of different models of mobile video systems. This inconsistent life cycle costing has led to additional training, inventory, and maintenance burdens and costs since the fleet has contained as many as eight different models of mobile video systems at any given time.

Since new systems were only purchased when funds were made available, and in quantities that have not allowed for the outfitting of every ISP enforcement vehicle, some ISP enforcement vehicles are not equipped with in-car video recording systems. Given that ISP officers above the

rank of sergeant spend less time on the road than troopers and sergeants, a strategic decision was made to install video recording systems only in vehicles assigned to troopers and sergeants. This strategic deployment of resources has resulted in approximately 370 state patrol vehicles being outfitted with video recording systems.

Though it may be advantageous to install video recording systems in every state patrol enforcement vehicle, even if resources were made available for this purpose, it is not clear that such use of additional resources would yield a favorable return on the investment.

As VHS-based mobile video systems near obsolescence, replacement parts will become difficult to obtain.

All ISP sworn personnel that have been assigned vehicles with mobile video recording systems are required to adhere to ISP mobile video recording policy. The current ISP policy is included as Appendix A. As part of a larger department wide effort to achieve accreditation by CALEA (Commission on Accreditation of Law Enforcement Agencies), departmental policies are being updated and improved. A revision of the ISP mobile video recording policy is part of this effort, is slated for adoption in early 2008. A draft of the revised policy is included as Appendix B.

#### ***Benefits of Video Recording (both analog and digital)***

The use of mobile video systems has resulted in numerous benefits to law enforcement including increased officer safety, documentation of traffic violations, citizen behavior and other events; reduced court time and prosecutor burden; video evidence for use in internal investigations; reduced frivolous lawsuits; and increased likelihood of successful prosecution (International Association of Chiefs of Police). In-car cameras will continue to have a positive impact on officers' perception of safety and their ability to respond to complaints regarding professionalism and courtesy. Prosecuting attorneys and the Courts will continue to expect that video evidence will exist in nearly all traffic cases and some criminal cases that come before them. The use of mobile video recording systems will continue to produce effective training materials for law enforcement. The Iowa State Patrol will continue to depend on the use of mobile video footage for the purpose of evaluating personnel performance and professionalism.

## **II. Assessment of Digital Recording Technology**

### ***Media and Data Storage***

The most current mobile video systems manufactured today utilize digital technology and digital recording media. Common media options include hard drives, DVD recorders, and solid state memory (flash memory). Systems range in design from those that are fully contained in the vehicle's dash to those systems that include a small storage compartment that fits in the vehicle's police equipment rack. In most cases, digital systems are compact enough that no trunk unit/vault is required.

Research and experience has shown that storage devices that employ moving parts, such as hard drives and disks, do not respond well to a mobile environment. The earliest generation of both analog, and now digital recording systems, that employ extensive use of moving parts, have had high failure rates. The rapid and high failure rate of first generation analog systems was rather quickly replaced by vastly improved, more reliable models. ISP anticipates that similar improvements will be made in digital video recording systems.

To minimize the risk associated with the use of the latest digital video recording systems, serious consideration should be given to avoiding systems that write data by use of rotating media or other media using moving parts. These concerns are especially critical for the Iowa State Patrol, which covers a vast territory that includes thousands of miles of gravel roads, and extensive hours logged in extreme weather conditions, to include extended operation at both temperature extremes (high and low), and during major weather events, to include electrical storms, snowstorms, ice events, and heavy rainstorms. Given the operating environment for the Iowa State Patrol, solid state devices appear to be the most appropriate devices, at least until non-solid state systems have improved and demonstrated a favorable track record.

A sixteen gigabyte (16 GB) storage device will store six to ten hours of video data recorded at 640 x 480 resolution (VGA) at 30 frames per second (or a range of 1.6 GB per hour to 2.66 GB per hour). Variables most greatly affecting the amount of storage required for video images are

the compression technology employed, and the nature of the images being captured. Most video compression algorithms can achieve far greater compression ratios with static images captured by a camera in a stopped car, as compared to active images captured by a camera in a moving car. The more active images that are captured, the lower the compression ratio will be, and as a result, more storage capacity is required.

By comparison, a VHS tape holds six hours of recorded video. While it is possible to select different recording speeds to capture more or less recording time on a single tape, there are not great variations in compression technologies as is the case with digital video capture technology, and there is no difference in the amount of tape used when images are captured by a camera in either a stopped or a moving car.

In the case of an analog recording system that uses VHS tape, or in the case of a digital video system that uses solid state memory, a DVD recorder, or a removable hard drive, each type of recording media has a set capacity. Once the capacity of the media is reached, no further images can be recorded without either downloading data to a server (sometimes done by wireless network connection at police headquarters or a fuel filling station, which would not be viable for ISP given the geographic deployment of troopers in all 99 Iowa counties) or by changing media (inserting a new flash memory card, hard drive, or DVD). As such, neither digital nor analog systems are immune from the inherent limitations associated with storage capacity.

Under the "Statement of Context" at the beginning of this report, a specific question was asked regarding any possible advantages of digital video systems with regard to the capacity of storage media. The previous review of storage capacity for both analog and digital video recording systems reveals that both types of systems have capacity limitations, which are inherent to the capacity limitation of the recording media in use.

Pursuant to State Patrol procedures, tapes containing video evidence captured by VHS-based systems must be stored in a secure facility. To parallel this protocol with digital video, data would have to be stored on secure, restricted access servers at ISP district offices across the state. Under normal circumstances, tapes are kept for ninety days before their contents are erased by a

district sergeant. If a trooper works sixty days out of a ninety day period, and given that a typical shift results in two hours of recorded events, to achieve the 90 day retention, each trooper can be expected to amass approximately one hundred twenty (120) hours of video in any ninety day period.

With a digital system, each trooper would require between one hundred ninety-two (192 GB) gigabytes and three hundred nineteen gigabytes (319 GB) of storage space on a server, assuming that a server based storage option is selected, which clearly appears to be the most viable option given ISP's statewide deployment of troopers. The average State Patrol district includes about twenty-six troopers and sergeants. Therefore, at a minimum capacity of 192 GB per trooper, each ISP district would require at least five terabytes of storage space (26 troopers x 192 GB per trooper, minimum). By way of comparison, to retain 90 days of analog video recorded on six hour tapes, approximately 520 tapes must be cataloged and stored at all times (120 hours per trooper / 6 hours per tape x 26 troopers).

Neither digital nor analog appear to offer any particular benefit with respect to field of view (a range of wide angle zoom cameras are available for both systems), simplicity of use, or audio recording quality, though it should be noted that audio performance should be a key criteria in the evaluation of any analog or digital system.

#### ***Video review, cataloging, storage, and retrieval***

Monitoring, cataloging, storing, and retrieving images stored on analog VHS tapes is labor intensive, particularly for district sergeants, but also for individual troopers and ISP clerical staff. It is anticipated that the same procedures would apply to digital video evidence that would be stored on a server (or DVD, if such a system were selected). However, one benefit of employing server-based storage would be the elimination of the need for physical storage for VHS tapes or DVDs. Recorded events can be classified by officers so that they can be quickly retrieved when necessary. Beyond basic cataloging capabilities, it is expected that digital video recording systems will soon be widely available with the capability of fully integrating the in-car recording system with the in-car computer.

Retention policies could be enforced automatically through the use of data management software that accompanies digital mobile video systems. Many of the available digital video management software packages also include the ability to track "chain of custody" that is crucial for evidence accountability. While a server based system is clearly the preferred method of storing video images, in order to meet demands, such a system would need the capability to generate DVD copies of video segments for media requests, public information requests, legal proceedings, production of training videos, and other purposes.

### ***Unique Digital Capabilities & Enhancement Opportunities***

The conversion to digital video recording technology presents some opportunities to enhance capabilities, as digital technologies offer several features that are not available on typical analog systems.

Perhaps the single most compelling and unique feature is known as "pre-event recording" and "post-event recording." Most digital video recording systems available to law enforcement have the capability to capture, at any time, a previous period of time (typically 30 seconds), when the recorder was not initiated to record. Since the system is set to continuously receive and retain data in a buffer (typically 30 seconds), if a trooper's lights are not activated and the camera is not recording, but an event occurs within the field of view of the digital camera, a trooper can capture and save an event after the fact. Some models can even accomplish this automatically when the impact of a crash or other extreme forces are detected. Likewise, digital systems have "post-event recording" capability that allows for the capture of images that occur in a period of time after lights are de-activated and recording ceases.

There are certain other features that are available on both analog and digital systems, but that would be considered only in the event of conversion to digital. Given the impending obsolescence of analog systems, it would not be wise to seriously consider upgrading to obtain new functionality on equipment that will soon become obsolete. These enhanced features include:

- the ability to use two or three cameras (front, rear, back-seat), with simultaneous two-channel recording capability;



- integration with radar systems to present target speed as real-time metadata along with video images captured by the camera;
- capture of certain “indicator status” items, such as the operational status of lights, sirens, and officer microphone status (such as “out-of-range”); and
- GPS data integration, which provides real-time presentation of latitude, longitude, speed, direction of travel, along with standard metadata, including date, time, officer identification, and agency identification.

### ***Digital Technology Standards***

Given that digital video recording technology is an emerging technology, particularly its application to a mobile environment for law enforcement purposes, any consideration of conversion to digital technology must involve careful consideration of standards. For more than two years, a panel of law enforcement officials, scientists, and equipment manufacturers have been cooperating in a major effort championed by the International Association of Chiefs of Police (IACP) to develop voluntary national standards for in-car digital video systems. The panel has continually refined and enhanced a draft standard. The latest draft, which is version 12, is a near-final standard covering a broad range of critical considerations, to include:

- Officer/Occupant Safety
- General Mobile Video System Specifications
- Security Features
- Digital Asset Recording
- Data Point for Interoperability

ISP suggests that it would be unwise and inefficient to attempt to develop a set of performance standards specifically for the Iowa State Patrol, or Iowa generally, as the quality, thoroughness, and rigor of the IACP standards is almost certain to result in near universal recognition and adoption of the IACP model as an industry standard. The IACP draft standard is included as Appendix C to this report.

### **III. Advantages, Disadvantages, Comparables, and Opportunities for Enhanced Functionality**

This report was initiated based on the premise that there may be advantages for both the public and the Iowa State Patrol if ISP begins conversion to digital in-car recording technology. Though numerous advantages have been identified, perhaps the greatest lesson learned in the course of this study is that the mobile video recording industry has now been making it very clear that manufacture and support of analog in-car video recording systems will cease in the near future. Even if the advantages of conversion to digital video are not sufficiently compelling to begin conversion, the practical and economic barriers to maintaining analog equipment and systems, when parts and replacement units will no longer be available, will compel the Iowa State Patrol and all other law enforcement agencies to begin planning for the transition to digital video recording systems.

Though the current state of the industry may compel a transition, it is nonetheless useful and important to provide a review and synopsis of the major advantages and disadvantages of digital video recording systems.

#### ***Advantages***

- Availability of equipment and support services.
- Reduced need for physical storage space for tapes.
- Reduced burden associated with review, cataloging, and retrieval of video segments (assuming integration with in-car computer system).
- Capability of enabling remote access to recordings by command staff.
- Ability to institute a second layer of protection of video evidence by restricting access to recordings through digital rights management (over and above the first layer security provided by restricting physical access to tapes (in the case of VHS) or the file server (in the case of digital)).
- Ability to automatically log the date and time that a recording is created, transferred, copied, and otherwise accessed, establishing a clear chain of custody.
- Pre-event recording.

### ***Disadvantages***

- Requirement to have significant technology infrastructure to support collection, storage, and use of recordings.
- Many digital video camera technologies have lower image quality than analog video recording technology. To ensure comparable quality, ISP recommends that any digital recording equipment acquired must meet IACP standards.

### ***Comparables (neither an advantage, nor a disadvantage)***

- Camera “field of view” (a broad range of fixed or adjustable focal length cameras are available for both analog and digital systems, include fixed focal length cameras, and wide angle to telephoto zoom lens cameras).
- Audio recording quality.
- No major difference in complexity of system use and associated training requirements.

### ***Opportunities for Enhancement of Features/Capabilities***

- Two to three cameras (front, rear, back-seat), with simultaneous two-channel recording capability.
- Radar integration (target speed presented as real-time metadata along with video recording) (*NOTE: Both analog and digital camera systems are available with radar integration capability, however, ISP is most likely to consider enhanced functionality only if a system conversion is undertaken. Given industry plans to cease production of analog recording systems, any system conversion will involve digital technology acquisition*).
- Indicator status metadata capture (indicators provided for operational status of lights, sirens, microphone) (*NOTE: Both analog and digital camera systems are available with indicator status metadata capture capability, however, ISP is most likely to consider enhanced functionality only if a system conversion is undertaken. Given industry plans to cease production of analog recording systems, any system conversion will involve digital technology acquisition*).

- GPS data integration (latitude, longitude, speed, direction of travel, along with standard metadata, including date, time, officer identification, and agency identification).

#### **IV. Rules of Evidence**

The Rules of Evidence, contained in Iowa Court Rules Chapter 5, were carefully reviewed for possible implications for the use of digital video recording technology in a law enforcement context. While the Rules of Evidence are a critical consideration for law enforcement agency collection, handling, use, and storage of both evidence and evidence collection equipment, most of the Rules of Evidence address matters that apply equally to both analog and digital video recordings, and all other forms of evidence as well. For example, Rule 5.402 establishes a relevancy requirement that clearly establishes that relevant evidence is admissible, subject to exceptions, while irrelevant evidence is inadmissible.

**Rule 5.402 Relevant evidence generally admissible; irrelevant evidence inadmissible.** All relevant evidence is admissible, except as otherwise provided by the Constitutions of the United States or the state of Iowa, by statute, by these rules, or by other rules of the Iowa Supreme Court. Evidence which is not relevant is not admissible.  
[Report 1983; November 9, 2001, effective February 15, 2002]

Whether moving images are captured on an analog or digital video recording system, such images are either relevant to the prosecution of a criminal charge, or irrelevant, but the question of relevancy is independent of the technology used to capture the images.

As another example, Rule 5.106 provides that when a portion of an act, declaration, conversation, writing, or recorded statement is introduced as evidence, generally, the remainder of the act, declaration, conversation, writing, or recorded statement is generally admissible.

**Rule 5.106 Remainder of related acts, declarations, conversations, writings, or recorded statements.**

*a.* When an act, declaration, conversation, writing, or recorded statement, or part thereof, is introduced by a party, any other part or any other act, declaration, conversation, writing, or recorded statement is admissible when necessary in the interest of fairness, a clear understanding, or an adequate explanation.

*b.* Upon request by an adverse party, the court may, in its discretion, require the offering party to introduce contemporaneously with the act, declaration, conversation, writing, or recorded statement, or part thereof, any other part or any other act, declaration, conversation, writing, or recorded statement which is admissible under rule 5.106(a). This rule, however, does not limit the right of any party to develop further on cross-examination or in the party's case in chief matters admissible under rule 5.106(a). [Report 1983; November 9, 2001, effective February 15, 2002]

Again, whether a portion of an act, declaration, conversation, or recorded statement is captured on an analog or digital video recording system, the admissibility of remainder of the act, declaration, conversation, or recorded statement is governed by the Rule, independent of the question of the technology used to capture the information.

The most relevant Rules to consider with respect to the question of digital video recording systems are contained in Article X, which pertains to contents of writing, recordings, and photographs. Though Iowa Court Rules, Chapter 5, Article X, is lengthy, the most critical and relevant consideration appears to be the definitions section contained in Rule 5.1001.

**Rule 5.1001 Definitions.** For purposes of this article the following definitions are applicable:

(1) *Writings and recordings.* "*Writings*" and "*recordings*" consist of letters, words, or numbers, or their equivalent, set down by handwriting, typewriting, printing, photostating, photographing, magnetic impulse, mechanical or electronic recording, or other form of data compilation.

(2) *Photographs.* "*Photographs*" include still photographs, X-ray films, video tapes, and motion pictures.

(3) *Original.* An "*original*" of a writing or recording

is the writing or recording itself or any counterpart intended to have the same effect by a person executing or issuing it. An "original" of a photograph includes the negative or any print therefrom. If data are stored in a computer or similar device, any printout or other output readable by sight, shown to reflect the data accurately, is an "original."

(4) *Duplicate*. A "*duplicate*" is a counterpart produced by the same impression as the original, or from the same matrix, or by means of photography, including enlargements and miniatures, or by mechanical or electronic re-recording, or by chemical reproduction, or by other equivalent techniques which accurately reproduce the original. [Report 1983; November 9, 2001, effective February 15, 2002]

The plain language of Rule 5.1001, Subrule 2, which defines "photographs," could present a problem for the use of digital recording technology if it only used the words "video tapes," however, it also defines photographs to include "motion pictures," which appears to be sufficiently broad to include moving images stored on media other than video tapes. In fact, Subrule 3, which defines the word "original," specifically references data stored in a computer. As such, the existing definitions contained within the Rules of Evidence appear entirely adequate to allow for the use of digital video recording technology, and such technology is already in use by a number of local law enforcement agencies in Iowa.

Given that Rule 5.1001, Subrule 3, provides that output derived from data must be "...shown to reflect the data accurately...", consideration will need to be given to printing and other forms of display to ensure that any technology used does indeed reflect the data accurately. Though this consideration is important, it is anticipated that meeting the threshold of accuracy will not be a significant barrier.

## **V. Implementation Concerns**

The ISP Office of Planning and Technology estimates that if sufficient resources were made available to outfit the entire fleet of enforcement vehicles assigned to troopers and sergeants, including associated infrastructure, the process of establishing the necessary technological

infrastructure, soliciting bids and awarding a purchase contract, ordering and taking delivery of equipment, outfitting all vehicles with new equipment, and training personnel in the use of the equipment would take at least two years. Due to the enormity of the task of simultaneous conversion of the all ISP enforcement vehicles assigned to troopers and sergeants, a more modest and measured transition appears to be the most practical and economical approach to conversion.

The use of server-based storage, which is the most viable option for ISP, would require closer examination of the department's wide area network due to the large amount of data that would need to be transferred across the network. Presently, T-1 network connectivity exists at each of the State Patrol's district offices. Servers would need to be acquired for each of the district offices. These servers would be responsible for distributing the video data to a central database on a gradual basis so as not to unnecessarily burden network performance.

Ideally, central control of all video evidence would be assumed by General Headquarters personnel who would be responsible for the custody of this evidence. This would require that each district house its own server that could be remotely accessed and maintained from a central location at General Headquarters. Working with video data files over the wide area network will require additional bandwidth to each of the State Patrol's fourteen district offices (excludes two specialized districts, Post 15 and Post 16). Additional bandwidth resources could be afforded to the district offices by installing fiber optic lines at each site.

The State Patrol has consulted with the Iowa Communications Network (ICN), and preliminary information would indicate that bandwidth resources could be significantly increased by capitalizing on Iowa's statewide fiber optics infrastructure. It should be noted that the enhancement of bandwidth resources at the district offices would also facilitate growth for future technology initiatives not only for the Iowa State Patrol, but also for all other enforcement divisions within DPS (Division of Criminal Investigation, Division of Narcotics Enforcement, and State Fire Marshal Division).

## **VI. Cost**

The assessment of digital video technology contained in the preceding sections of this report established a baseline for the equipment and infrastructure necessary for conversion to digital technology. The following table contains estimates for the total costs of conversion, excluding any enhanced functionality that might be considered, such as radar integration and indicator status metadata capture.

### **ESTIMATED COST OF DIGITAL MOBILE VIDEO IMPLEMENTATION IN THE IOWA STATE PATROL**

	Units	Cost	Total
<b><u>In-Car Camera Expenses</u></b>			
Digital Mobile Video System (low estimate, most basic system)	370	4,800.00	1,776,000.00
Digital Mobile Video System (high estimate, system with many enhanced features)	370	9,000.00	3,330,000.00
Digital Mobile Video System (mid-range estimate)	370	6,900.00	2,553,000.00
<b><u>District Office Expenses</u></b>			
5 Terabyte Server (Temporary Storage – 1 per ISP District)	14	9,723.00	136,122.00
80 Terabyte Disk Array (Central Storage)	1	135,103.16	135,103.16
<b><u>Network Expenses</u></b>			
Network Switch/Router	14	3,731.80	52,245.20
Fiber Optic Installation (average cost per district)	14	62,878.57	880,299.98
		<b>Total</b>	<b>3,756,770.34</b>
<b><u>On Going Cost</u></b>			
DS3 Network Service per year	14	22,323.00	312,522.00



## **VII. Timeline Considerations**

This report was requested by the Iowa General Assembly with the intent of providing policymakers with the information necessary to determine whether the Iowa State Patrol, and the citizens of Iowa served by ISP, would benefit from conversion to digital video recording technology in ISP enforcement vehicles. While numerous benefits to conversion have been identified, perhaps the most important conclusion that can be drawn from this report is that conversion to digital video recording technology will have to begin in the near future given industry plans to cease production of analog recording systems for the mobile law enforcement environment.

While the practical need to convert to digital video recording technology is compelling, the implementation challenges of simultaneous fleet-wide conversion, and an environment of limited financial resources, suggest that the most viable approach for conversion would involve a gradual phase-in of new technology, commencing initially with conversion of only one of 14 ISP Districts. This project should include equipping all troopers and sergeants in the district with digital mobile video technology. All aspects of the mobile video procedure should be closely monitored during the initial phase to ensure that any unforeseen implementation barriers are identified and resolved. Staff in the ISP Office of Planning and Technology should continue to monitor the development of model minimum specifications for digital mobile video by the International Association of Chiefs of Police. Adhering to IACP model minimum specifications will ensure that the State Patrol aligns itself with law enforcement best practices identified through the extensive research and testing that is being conducted by the IACP.

## **Conclusion**

Mobile video systems serve as critical evidence collectors for the Iowa State Patrol, and they will continue to do so in the future. As aging VHS-based mobile video systems approach obsolescence, the industry has transitioned to systems that employ digital technology for capturing video footage. These digital mobile video systems store data using DVDs, hard drives, or solid state devices. In a mobile environment, solid state devices are more desirable because

they lack the moving parts that comprise DVDs and hard drives. Solid state devices, like flash cards, can be easily transported from the mobile video system to the district office where the data can be transferred into the server. Once in the server the data is archived until it is deleted in accordance with retention policies. When necessary, video data can be preserved for legal proceedings. In order to achieve and maintain the highest standards of data integrity and security, control and oversight of video evidence should be managed by personnel in General Headquarters.

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## **In-Car Audio Visual Equipment**

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The purpose of this procedure is to establish guidelines for the use of the In-Car Audio Visual Recording Equipment.

### **A. Definition**

Only approved In-Car Audio/Visual Recording Equipment shall be used in Iowa State Patrol vehicles. The equipment will consist of a camera, a control unit and TV monitor mounted in the driver's compartment, the VCR unit mounted in the trunk, the remote control unit on the Trooper's belt and the microphone worn on the uniform.

### **B. Purpose**

The In-Car Video Cameras and audio equipment's primary purpose is to collect evidence for use in prosecuting individuals who violate the law. Other purposes may include the following:

1. Troopers may wish to review recorded tapes prior to trial.
2. Recorded information may be subpoenaed as court testimony in civil and criminal cases.
3. Material collected on recorded tapes may be used for training purposes.
4. When the showing of a portion of a tape serves the law enforcement interests of the State Patrol.
5. Any use of taped material or recorded audio transmissions by anyone outside of the State Patrol shall be approved only by the Chief or a designee.

### **C. Supervision**

The affected District Commander or designated Assistant District Commander (DADC) shall supervise the use, storage, duplication and erasing of the material recorded by Troopers.

If a Trooper who is assigned the equipment detects any problem with any part of the recording equipment, he/she shall immediately bring this to the attention of the District Commander or a D.A.D.C.

#### **D. Equipment Operation**

Recording equipment shall be used only by Troopers the District Commander determines are properly trained in the use of the equipment and storage of the tapes. Troopers shall use tapes issued only by the State Patrol Division.

1. The Trooper shall activate the audio and visual equipment on every traffic stop, or citizen contact. The Trooper shall complete a short, audio narration of the activity to be recorded; minimally, the location and type of stop, or incident. If a Trooper discontinues taping an incident, he/she will make an audio explanation prior to shutting off the equipment. If a tape ends during a taping period, an audio explanation will be made at the beginning of the replacement tape.
2. Troopers are not required to inform the public that the recording equipment is in use, but shall disclose its use upon inquiry.
3. If recording equipment is equipped for multiple speeds, the recorder shall be set to record at the slowest recording speed to make the fullest use of the tape.
4. When the assigned Trooper concludes his/her work shift, he/she will indicate this with an audio explanation.
  - a. If another officer who has been properly trained in the use of the equipment uses a vehicle equipped with Audio Visual Recording Equipment and a tape is already in the recorder, he/she will make an audio explanation when the vehicle is put in service, otherwise, the equipment will not be used.

#### **E. Tape Control**

All tapes shall be stored at the District Office in the proper storage file for a period of 90 days before being erased. Only the District Commander, or the D.A.D.C., shall remove or replace tapes that have been stored in the District storage file.

1. The Trooper who uses the equipment shall notify the District Commander or D.A.D.C. of any recorded tapes and other evidence that needs to be stored for a period longer than 90 days. Those tape containers and other evidence will be appropriately marked so they are readily identifiable in the District Office storage file.
2. No tape should be re-used for recording purposes without first being erased. Erasing of recorded tapes shall not be completed without the approval of the District Commander or the D.A.D.C.
3. When a tape has been fully recorded, it shall be marked to show the Trooper's badge number, district, and the inclusive times and dates on the tape and it will be filed in a chronological order by officer and date.


4. Troopers shall maintain a sufficient supply of tapes for at least 14 working shifts.
5. The Districts shall maintain a stock of blank tapes to supply Trooper in their District for at least one month.

#### **F. Tape Custody**

1. Recordings generated on State Patrol equipment are the property of the Iowa State Patrol.
2. If any portion of a recorded tape is to be used as stated in Section B, the necessary portion shall be duplicated. The original tape shall remain in the District storage file.
  - a. The Trooper will maintain a daily log of the incidents that are recorded on a tape by counter number. This will facilitate quicker duplication.
3. District Commanders, or the D.A.D.C., shall maintain a control log that shall indicate the flow of recorded tapes, into and out of the storage file. The log shall indicate who is responsible for each transaction, the reason, time and date.

#### **G. Periodic Review**

Assistant District Commanders that supervise Troopers utilizing audio/visual recording equipment will select, at random, for review, at least two tapes per officer, per year. This will help to ensure the recording equipment is being operated according to this policy.

 <input type="checkbox"/> General Order <input checked="" type="checkbox"/> Division Order <input type="checkbox"/> Bureau Order <input type="checkbox"/> Special Order  Order No.: ----- <input type="checkbox"/> Procedure <input type="checkbox"/> Plan <input type="checkbox"/> Rule	<b>Iowa State Patrol</b>	
	<b>TITLE/SUBJECT:</b> Mobile-Video Recording Equipment	<b>IDENTIFIER:</b> DRAFT
	<b>TO:</b> All Sworn Personnel	<b>CC:</b>
	<b>RELATED DIRECTIVES/FORMS:</b> IA Code Chapter 22; Mobile Video Checklist; Criminal Interdiction Tape Review Log Sheet	
	<b>APPLICABLE CALEA STANDARD(S):</b> 41.3.8	
	<b>EFFECTIVE DATE:</b>	<b>REVISION #:</b>
<b>INSTRUCTIONS:</b>		

## I. PURPOSE

The purpose of this directive is to establish the procedures and guidelines for the operation of the in-car audio-video recording equipment in State Patrol vehicles, as well as establish retention, storage, disposition, and duplication policies.

## II. POLICY

It is the policy of the Iowa State Patrol that all Troopers that are properly trained and issued the authorized Mobile Video Recording Equipment will utilize that equipment on every traffic stop or citizen contact. The approved Mobile Video Recording Equipment shall consist of a camera, a control unit and monitor mounted in the driver's compartment, the recording unit mounted in the trunk, the remote control unit worn on the Trooper's belt and the microphone worn on the uniform.

## III. Definitions

**Recorded Media:** Refers to audio-video signals recorded on any of several storage devices, including analog tape(VHS, SVHS, Hi 8mm), digital tape(DV) or other portable digital storage devices(CD,DVD, hard drive, etc)

**In-car camera system and Mobile Video Recorder (MVR):** These are synonymous terms and refer to any system that captures audio and video signals capable of installation in a vehicle, and that includes at a minimum, a camera, microphone, recorder and monitor.

**MVR Technician:** Personnel trained in the installation, operational use and repair of MVR's. The term shall be synonymous with State Patrol Communications Technicians and members of Fleet and Supply staff that assist with the preparation and installation of equipment.

## IV. PROCEDURE

### a. Installation

All audio-video recording equipment utilized by the Iowa State Patrol shall be installed by authorized Iowa State Patrol MVR Technicians.

### b. Officers Responsibility

1. Officers issued the MVR equipment shall be responsible for all equipment issued to them and will ensure that the MVR recording equipment is maintained according to manufacturer's standards and departmental regulations. Any alteration or adjustment to this issued MVR equipment is strictly prohibited. If any component of the unit fails to operate, the officer shall notify State Patrol Communications that their unit is non-functioning and have the Communications Center Specialist log that information. Additionally, the officer shall notify the Assistant District Commander as to the nature of the problem as well.
2. The officer shall also be responsible for maintaining a supply of tapes sufficient for at least 14 shifts.

### c. Equipment Operation

- i. The Trooper shall activate the MVR equipment on every traffic stop, or citizen contact. The trooper shall complete a short, audio narration of the activity to be recorded. This includes the location and nature of the stop or incident, the plate number and state of origin if available, and any other information relevant to the stop or incident.
- ii. If the trooper discontinues recording an incident, the officer shall make an audio explanation prior to shutting off the equipment. If a tape ends prior to the end of the incident/public contact, the officer shall indicate this at the beginning of the replacement tape.
- iii. Officers shall activate their wireless microphone at all times when the recording equipment is in operation.
- iv. Officers shall not discontinue recording until the traffic stop/incident is completed.
- v. Troopers are not required to inform the public that the recording equipment is in use, but shall disclose its use upon inquiry.
- vi. If the recording equipment is equipped for multiple speeds, the recorder shall be set to record at the slowest recording speed to make the fullest use of the storage device.
- vii. When the assigned Trooper concludes their work shift, they will indicate this with an audio explanation.
  1. If another officer uses a vehicle equipped with Mobile Video recording equipment and a storage device is already in the recorder,

the officer will make an audio explanation indicating who the operator is at that time.

- viii. When a storage device is fully recorded, the officers badge number, district, and dates recorded on the tapes shall be reflected upon the tape prior to storage. The tape will be filed in chronological order by officer and date.
- ix. It is understood that unusual circumstances may arise that prevent the strict adherence to these procedures. However, Troopers should make every effort to comply with these procedures.

d. Supervisors Responsibility

1. The Assistant District Commander is responsible for reviewing a minimum of two (2) recorded media per year for each officer under their command. The Assistant District Commander shall review the incidents and complete the Mobile Video Checklist form that is located at G:\winword\forms\Mobile Video Checklist. Upon completion, the Assistant District Commander shall review the checklist with the officer and address any deficiencies noted. Additionally, the Assistant District Commander shall identify any potential training needs as they review the recordings.

2. The Assistant District Commander shall also review all recordings from any incidents or stops that would be of a criminal interdiction nature. The ADA shall ensure that the officer uses good officer safety techniques and complies with all Departmental and divisional rules and regulations. Assistant District Commanders shall complete all documentation as required on the log sheet that can be located at G:\winword\forms\criminterdictlog, and shall forward the log sheet to the District Commander. It shall be the responsibility of the District Commander to maintain the log sheet and to provide it upon request of Command Staff.

e. Tape Control

1. Each district shall designate a supervisor as the custodian of the tapes for the district. They shall be responsible for the use, storage, duplication, and erasing of all recorded materials. Only the District Commander or the Assistant District Commander, or Trooper who recorded the tape, shall remove or replace tapes that have been stored in the District storage file. All tapes should be stored at the District Office in the proper storage file for a period of 90 days. The exception shall be for tapes containing recordings of narcotics arrests. These shall be retained for a period of 6 years.

2. If there are any other recorded incidents that need to be retained past the 90 days, the trooper shall notify the custodian of the need to retain that tape. It shall be appropriately marked so that it is not erased or destroyed until the Trooper releases it.



3. No tape shall be re-used for recording purposes without first being erased. Erasing of the recorded tapes shall not be completed without the approval of the District Commander or custodian of the tapes.

f. Tape Duplication

- i. All recorded images and audio recording are the property of the Iowa State Patrol and duplication and dissemination outside of the Iowa State Patrol require the authorization of the Colonel or their designee.
- ii. Any requests for duplication of an incident by the county attorney shall be complied with at no cost to the county.
- iii. Other requests for duplication shall be handled as follows;
  1. Should a request be made for any recording on any case pending court, the video should generally be considered part of an investigative file and not released pursuant to Chapter 22 of the Iowa Code. Should the release for a recording come from a defendant in a pending criminal case, rules of discovery apply and the requestor should be referred to the county attorney with jurisdiction.
  2. For other requests, the District Commander or Assistant District Commander will obtain necessary information related to the request and forward that along with a copy of the recording and incident report for the incident in question to the Department of Public Safety's Public Information Officer as soon as practical.
  3. The Departmental PIO, in consultation with the Colonel/designee and the Departments Attorney General representative, shall review the recording and make a determination as to what, if anything is duplicated.
  4. The PIO shall contact the District Office where the request originated from and advise the District Commander or Assistant District Commander as to whether the request is approved or denied. Additionally, the PIO shall advise what, if anything, shall be redacted, and the legal authority for the redaction, prior to duplication and dissemination. Any questions with regard to a denial, or redaction, should be directed to the Department's PIO.
  5. If the recording is to be reproduced and disseminated as per the request, the requestor shall either provide a new, recording storage device for duplication, or remit the sum of the current cost for a departmental recording storage device.
  6. The District Commander/Assistant District Commander will provide a receipt to the individual upon receipt of the fees collected for the recording. No other costs will be assessed for duplication of the tape.
  7. A copy of all receipts issued and the fees collected for each month shall be submitted to the Departments Finance Bureau by the tenth of each month.

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**Colonel Robert O. Garrison, Chief**  
**Iowa State Patrol**

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**Date**

# International Association of Chiefs of Police

## Digital Video Systems Minimum Performance Specifications Document

Version 12 Dated January 18, 2007

### **In-Car Video Camera Systems Performance Specifications: Digital Video Systems Module**



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## **FOREWORD**

Over a period of 18 months, a panel of law enforcement representatives, scientists, and equipment manufacturers worked together in an unprecedented effort to develop a set of minimum performance benchmarks for digital in-car video systems. This open letter to all the participants in this project is to thank you – and commend you – for the spirit of cooperation, collegiality, and dedication to common goals that made this a true collaboration.

We all recognized the value of video technology for enhancing officer safety, fighting crime, and strengthening public support of the police.

Now it is up to all of us – equipment manufacturers, scientists, and police officers – to carry the message of this document forward to our customers and colleagues. It is our collective responsibility to make sure the technology in use by law enforcement is capable of providing high quality evidence to protect both the public and the police.

Industry representatives should use this opportunity to forge new relationships with each other. Use your renewed commitment to high quality video technology to identify to your customers the products that will best support police officers and the citizens they serve.

Law enforcement officials must use the power of peer-to-peer communication to inform colleagues of the critical importance of the quality of the images. In recent years, numerous court cases have depended on video from mobile recorders to help defend officers against charges of misconduct or, sadly, to speak for officers who are unable to speak for themselves.

The scientific community must help us find objective methods of measuring image quality, push the boundaries of current technology, and identify emerging technologies. Sharing this knowledge will benefit all stakeholders.

We want to sincerely thank all who have participated in this project, but remind you that the work is not yet complete. Some formidable challenges still lie ahead, and we will continue to count on your dedicated support of the goals of this project as we enter the next phase.

Chief Mike Burrige, Farmington, NM Police Department  
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## **Section 1 – General Information**

### **1.1 SCOPE**

This specifications document is limited in scope to digital in-car video systems used by law enforcement agencies.

### **1.2 PURPOSE**

The purpose of this document is to establish minimum performance specifications for digital recording systems to enhance 1) officer safety, and 2) the effectiveness of audio/video evidence by identifying the scientifically measured, minimum performance levels appropriate for use by law enforcement. To achieve this mission, the performance of digital systems must be objectively measured and the level of performance necessary and appropriate to meet the needs of law enforcement must be identified.

These standards apply to any mobile digital video equipment delivered to a law enforcement agency 18 months from the date of publication of the minimum performance specifications and must meet the minimum performance standards and show proof of certification and compliance, as determined by the International Association of Chiefs of Police (IACP).

### **1.3 DEFINITIONS**

“Recommended, Should, May,” state preferred practices that agencies “may” deviate from.

“Will, Shall, Must,” “will” denote mandatory key safety items that are crucial for officer safety and “shall” not be deviated from.

**1.3.1 Absolute Time Code:** Absolute time code (ATC) is generally recorded in the subcode or control track region of any digital tape. This is the code that digital tape machines use to locate specific points on a tape for autolocation or other functions. In some machines it is even used to synchronize the tape to other equipment. ATC is very accurate and usually conforms to the IEC standard, which is easily converted to the more commonly used SMPTE time code. Unlike SMPTE, ATC always begins at zero at the beginning of a digital tape. Some DAT machines have the ability to function without ATC on a tape while others simply will not play a tape without it. Almost all current machines record it automatically so it should always be on every tape.

**1.3.2 Acceptance test:** This refers to any procedure used when a new product is received, or a product is returned from maintenance, to verify that a product or software is performing according to the manufacturer’s specifications for a specific use. Common examples include but are not limited to: the use of diagnostic software to test a new computer before it is used to process evidence, and the processing of a set of

know standards to verify that the known standards can be processed within an acceptable range of results.

**1.3.3 Accuracy:** 1) This can refer to the overall range of values within which the actual value obtained is considered to be within tolerance or acceptable. For example in the early days of color printing, machine prints (amateur quality you get from the 1-hour mini lab today) were considered to be acceptable if the color balance was within  $\pm 30$ CCs of the ideal color balance. However, for custom (professional lab) printing the acceptable range of variation was  $\pm 5$ CCs of the ideal color balance. 2) This can refer to how close the actual value obtained is to the range of acceptable values. For example, is the color balance close enough to the optimal color balance so that it can be considered a fair and accurate photographic reproduction. 3) This can refer to the margin of error in measuring something.

**1.3.4 Active Storage:** A storage location or device (i.e. Server), which videos are transferred to from the in-vehicle recorder using any method. Active Storage shall provide ready access to recently recorded videos which have not been moved to Archival Storage due to elapsed time from original recording creation date. Access to videos in Active Storage may or may not require Administrator interaction based on departmental policy.

**1.3.5 Administrative Review:** A procedure used to check for consistency with agency/laboratory policy and for editorial practice.

**1.3.6 Amperage:** A measurement of electrical current.

**1.3.7 Archival Image:** Any image placed on media that is suitable for long-term storage.

**1.3.8 Archival Storage:** A storage location or device which videos are moved to after a designated amount of time. Access to videos contained within Archival Storage may be limited and require Administrator authorization to review or move back to Active Storage. Media for Archival Storage may include: tapes, spinning optical media (CD, DVD, Blue-Ray, HD-DVD, etc.), hard drives, etc.

**1.3.9 Archive:** Off-line storage of video/audio intended for long-term storage and retrieval.

**1.3.10 Archive Copy:** A copy of data placed on media suitable for long-term storage and retrieval.

**1.3.11 Archive Image:** 1) Any Image placed on media that is suitable for long-term storage. 2) A bit stream duplicate of the original data placed on media that is suitable for long-term storage and retrieval.

**1.3.12 Archiving:** Long-term storage of data.

**1.3.13 Authentication:** 1) A security measure designed to protect a communications system against acceptance of a fraudulent transmission or simulation by establishing the validity of a transmission, message, or originator. 2) A means of identifying individuals and verifying their eligibility to receive specific categories of information. 3) Evidence by proper signature or seal that a document is genuine and official. 4) In evasion and recovery operations, the process whereby the identity of an evader is

confirmed. 5) A means of proving the origin of the evidence and that it has not subsequently been altered (or, where alteration has occurred, that such alterations are properly identified). 6) The process of determining whether a recording or image is original, continuous, and free from unexplained alterations (e.g., additions, deletions, edits, or artifacts) and is consistent with the stated operation of the recording device used to make it.

**1.3.14 Authenticity:** The quality or condition of being authentic, trustworthy, or genuine.

**1.3.15 Bundled:** Accessories or software that is included in the purchase of the main item such as a computer or a major software application.

**1.3.16 Capture:** The process of recording data, such as an image, video sequence, or audio stream.

**1.3.17 Capture Device:** A device used to record audio, photographic, graphic, or video data.

**1.3.18 CD/DVD (compact disc/digital versatile disc):** Optical disc formats designed to function as digital storage media.

**1.3.19 Chamfer:** To cut off the edge or corner of, bevel.

**1.3.20 Chain Of Custody:** The chronological documentation of the movement, location and possession of evidence.

**1.3.21 Consistency:** The degree of uniformity, standardization, and freedom from contradiction among the Video/Data or parts of a system or component

**1.3.22 Copy:** An accurate reproduction of information.

**1.3.23 Corruption:** A process wherein data in memory or on disk is unintentionally changed, with its meaning thereby altered or obliterated.

**1.3.24 DAT:** Digital Audio Tape.

**1.3.25 Data Capture:** The collection of information at the time of a transaction.

**1.3.26 Data Extraction:** The identification and recovery of information contained within a recording, which may not be immediately apparent through visual/aural inspection.

**1.3.27 Data File:** A file consisting of data in the form of text, numbers, or graphics, as compared to a program file of commands and instructions.

**1.3.28 Data integrity:** The accuracy of data and its conformity to its expected value, especially after being transmitted or processed.

**1.3.29 Date stamping:** A software feature that automatically inserts the current date into a document.

**1.3.30 Digital Evidence:** Information of probative value that is stored or transmitted in binary form.

**1.3.31 Digital Asset:** Recorded video, audio, and associated metadata.

**1.3.32 Digital Image:** A photographic image that is represented by discrete numerical values organized in a two-dimensional array. Each discrete block is called a pixel.

**1.3.33 Digital Recording:** The storage of information in a binary-encoded (digital) format. Digital recording converts information--text, graphics, sound, or pictures--to strings of 1s and 0s that can be physically represented on a storage medium.

**1.3.34 Download:** The process of receiving data from another digital source.

**1.3.35 Duplicate:** An acceptably accurate and complete reproduction of all data objects independent of the physical media.

**1.3.36 Encryption:** The process of coding data so that a specific code or key is required to restore the original data. In broadcast, this is used to make transmission secure from unauthorized reception as is often found on satellite or cable systems.

**1.3.37 Export:** To move information from one system or program to another. Files that consist only of text can be exported in ASCII (plain text format). For files with graphics, however, the receiving system or program must offer some support for the exported file's format.

**1.3.38 Format Conversion:** To transfer audio and/or video information from one media type to another and/or from one recording method to another.

**1.3.39 Hash:** A mathematical formula that generates a numerical identifier based on input data. If any bit of the input data used to calculate the numerical identifier changes, the output number changes.

**1.3.40 Image:** 1) A bit stream duplicate of the original data. 2) An imitation or representation of a person or thing, drawn, painted, or photographed.

**1.3.41 Image Authentication:** This is the scientific examination process used to verify that the information content of the analyzed material is an accurate rendition of the original data by some defined criteria. These criteria usually involve the interpretability of the data, and not simple format changes that do not alter the meaning or content of the data. Examples include: Determining the degradation of a transmitted image; Determining whether a video is an original recording or an edited version; Evaluating the degree of information loss in an image saved using lossy compression. Determining whether an image contains feature-based modifications such as the addition or removal of elements in the image (e.g., adding bruises to a face).

**1.3.42 Image Capture:** The transducing of the information in a real image into the photographic or electronic medium. Normally in motion-reproducing systems, synchronous audio information is simultaneously transduced.

**1.3.43 Image Transmission:** The act of moving images from one location to another.

**1.3.44 Import:** To bring information from one system or program into another. The system or program receiving the data must somehow support the internal format or structure of the data.

**1.3.45 Integrity:** 1) The completeness of the potential evidence throughout its lifecycle. 2) The degree to which a system or component prevents unauthorized access to, or modification of, digital Video and or data associated with such video. 3) The

steadfast adherence to a strict moral or ethical code set by guidelines in the policy and procedures process of handling in car video.

**1.3.46 Intermediate Storage:** Any media or device on which data is temporarily stored for transfer to permanent or archival storage.

**1.3.47 Locked file:** A file on which one or more of the usual types of manipulative operation cannot be performed--typically, one that cannot be altered by additions or deletions.

**1.3.48 Log File:** A record of actions, events, and related data.

**1.3.49 Logical Copy:** An accurate reproduction of information contained within a logical volume.

**1.3.50 Mass Storage:** Any device for the storage of large amounts of data.

**1.3.51 Metadata:** Data, frequently embedded within a file that describes information about or related to the file or directory in which it is embedded. This may include but is not limited to the locations where the content is stored, dates and times, application specific information, and permissions.

**1.3.52 Multimedia Evidence:** Analog or digital media, including, but not limited to, film, tape, magnetic and optical media, and/or the information contained therein.

**1.3.53 Native File Format:** The original form of a file. This usually refers to a file format that is associated with and unique to a specific software application program.

**1.3.54 Network Topology:** Graphical representation of a network.

**1.3.55 Physical Copy:** An accurate reproduction of information contained on the physical device.

**1.3.56 Physical Image:** A bitstream duplicate of data contained on a physical device.

**1.3.57 Pinch Points:** Points at which it is possible to be caught between moving parts, or between moving and stationary parts of a piece of equipment.

**1.3.58 Potential Evidence:** Items that have yet to be determined if it will be used in the adjudication of civil or criminal activity. The items under consideration are: Video recordings; Audio recordings; Metadata associated with the recorded potential evidence

**1.3.59 Primary Image:** Refers to the first instance in which an image is recorded onto any media that is a separate, identifiable object. Examples include a digital image recorded on a flash card or a digital image downloaded from the Internet.

**1.3.60 Processed Image:** Any image that has undergone enhancement, restoration or other operation.

**1.3.61 Proxy:** A Type 2 duplicate of a Primary Image.

**1.3.62 Recorded Evidence Reference Lifecycle:** The stages or states in which a recording will exist from the time it is created until it is destroyed.

**1.3.63 Reference Lifecycle:** The stages or states that are applicable to the recommendations in this document.

**1.3.64 Reliability:** The extent to which information can be depended upon.

**1.3.65 Removable Media:** Storage media that can be removed from the camera and/or computer.

**1.3.66 Storage Media:** Any object on which data is preserved.

**1.3.67 Transcoding:** (FV) This refers to converting a data stream from one format to another, such as MPEG-1 to H.263, or an H.320 video conferencing session to H.323.

**1.3.68 Type 1 Digital Asset:** A duplicate recording that has been created that passes the applicable Integrity, Consistency, and Authenticity checks. The record contains all chain of custody evidence and support.

**1.3.69 Type 2 Digital Asset:** A duplicate recording has been created that does not contain the chain of custody evidence and support.

**1.3.70 Validation:** The process of performing a set of experiments, which establishes the efficacy and reliability of a tool, technique or procedure or modification. This is a requirement for any custom application software before it can be used for forensic applications. This is also recommended for commercial applications. In the forensic setting, this usually involves the processing of what the user considers to be a representative sample of the type or types of evidence to be processed.

**1.3.71 Validation Testing:** An evaluation to determine if a tool, technique or procedure functions correctly as intended for a specific application using a representative sample.

**1.3.72 Validity check:** The process of analyzing data to determine whether it conforms to predetermined completeness and consistency parameters.

**1.3.73 Vehicle Video Evidence Capture System Reference Lifecycle:** The stages or states in which the recording equipment in the vehicle, e.g. recorder, camera, etc., will exist from the time it is first received by the operating agency until it is properly disposed of.

**1.3.74 Verification:** 1) A scientific procedure followed by a second qualified examiner to confirm that the examination performed by the first examiner is scientifically valid. In most forensic laboratory settings this also includes the procedures to be followed in the event that there is a disagreement over the scientific validity of the examination performed by the first examiner. 2) The process of confirming the accuracy of an item as compared to its original.

**1.3.75 Video:** The electronic representation of a sequence of images, depicting either stationary or moving scenes. It may include audio.

**1.3.76 Video Capture:** This is the process of converting analog video to digital video.

**1.3.77 Video clip:** A file that contains a short continuous video recording, usually of one scene.

**1.3.78 Video Evidence Physical Recording Media Lifecycle:** The stages or states in which the removable recording media used to capture video evidence, e.g. digital



tape, Digital Video Disk (DVD) etc., will exist from the time it is first received by the operating agency until it is properly disposed of.

**1.3.79 Write Block/Write Protect:** Hardware and/or software methods of preventing modification of media content while the media content is being read. In the forensic examination of evidence these devices perform a critical function by allowing the examiner to make an image, recover deleted files that have not been overwritten, examine files, and/or copy files without altering any data on the storage media being examined.

**1.3.80 Work Copy:** A copy or duplicate of a recording or data that can be used for subsequent processing and/or analysis.

## 1.4 ACRONYMS

ABA	American Bar Association
AFSC	United States Air Force Standard Charts
ANSI	American National Standards Institute
ASR	Aerosol Subject Restraint
ASCLD-LAB	American Society of Crime Lab Directors/Laboratory Accreditation Board
CPSC	Consumer Product Safety Commission
DSS	Digital Spread Spectrum
DVS	Digital Video System
EDD	Electronic Disruption Devices
EIA	Electronics Industry Association
ESSID	Extended Service Set Identification
ETATS	Enforcement Technologies Advisory Technical Subcommittee
FCC	Federal Communications Commission
FMVSS	Federal Motor Vehicle Safety Standards
HF	High Frequency
IACP	International Association of Chiefs of Police
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronic Engineers
ISO	International Standards Organization
MDT	Mobile Data Terminal
MDVR	Mobile Digital Video Recorder
MVS	Mobile Video System
NFPA Intl	National Fire Protection Association International
NHTSA	National Highway Transportation Safety Administration
NTSC	National Television System Committee
RC4	Rivest Cipher 4
RFP	Request for Proposal
SAE	Society of Automotive Engineers
SIA	Security Industry Association
SMPTE	Society of Motion Picture and Television Engineers
SSID	Service Set Identification

<b>SSL</b>	Secure Sockets Layer
<b>UHF</b>	Ultra High Frequency
<b>UL</b>	Underwriters Laboratories
<b>UL of Canada</b>	Underwriters Laboratories of Canada
<b>VHF</b>	Very High Frequency
<b>VVCS</b>	Vehicle Video Capture System
<b>WMV</b>	Windows Media Format
<b>WORM</b>	Write Once, Read Many

### **1.5 UNITS OF MEASURE**

Reference the standards to which the measurements apply. In all other cases, Society of Automotive Engineers (SAE) measurement standards will be used.

## **Section 2 - Applicable Standards**

**2.1** All mobile video systems and related audio equipment must conform to the applicable minimum standards as set by the:

- a) American Society of Crime Lab Directors/Laboratory Accreditation Board (ASCLD-LAB)
- b) Electronic Industries Association (EIA)
- c) Federal Communications Commission rules and regulations (FCC)
- d) Institute of Electrical and Electronic Engineers (IEEE)
- e) International Electrotechnical Commission (IEC)
- f) International Organization for Standardization (ISO)
- g) National Fire Protection International (NFPA)
- h) National Highway Transportation Safety Administration (NHTSA)
- i) National Television System Committee (NTSC)
- j) Society of Automotive Engineers (SAE)
- k) Underwriters Laboratories Inc. (UL)
- l) Underwriters Laboratories of Canada (Canada UL)

**2.2** Vendors must be able to provide a White Paper that establishes that it adheres to the minimum specifications of this document, and that the technology used is generally accepted in the relevant field.

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### **Section 3 - Officer/Occupant Safety**

#### **3.1 For items installed or located in the passenger compartment of the vehicle**

3.1.1 No item installed in the interior of the passenger compartment shall increase the risk of injury to occupants during events related to a vehicle crash as defined below.

3.1.1.1 Items installed or located in the interior of the vehicle shall remain in place during a reasonably foreseeable crash. This will be determined by a static pull test. The force applied to the item will correspond to 50 times its own weight (50g). This force must be maintained for at least one (1) full second. The test shall be conducted from a minimum of three (3) different angles to simulate frontal, side and rear collision directions. The item must remain attached to its mounting points during this test. The item will be allowed to move or pivot on any adjustable mounts or joints as long as it does not move into a location that could increase the likelihood of impact with an occupant or into a hazardous area such as an airbag deployment zone.

3.1.1.2 Any items installed in the interior of the vehicle shall meet the requirements stated in Federal Motor Vehicle Safety Standard 201 [October 1, 2002] *Occupant Protection in Interior Impact* (see Appendix A).

3.1.1.3 Exposed exterior surfaces, corners, fasteners, and controls that could be contacted by an occupant during a collision shall be of a design that minimizes the potential for injury. Edges and corners shall have a minimum 1/8-inch (3.2mm) radius or chamfer or be padded with an energy absorbing material to minimize the risk of injury.

Note: This correlates to Federal Motor Vehicle Safety Standard 201(S5.4) [October 1, 2002] (See Appendix A).

3.1.1.4 No equipment will be installed in any original vehicle manufacturer's designated air bag deployment zone. Alternatively, this requirement can be met if the airbag corresponding to the air bag deployment zone that is violated is turned off or disabled in accord with National Highway Traffic Safety Administration guidelines and any vehicle occupants are clearly warned with a readily visible placard or illuminated indicator that the airbag has been disabled.

3.1.1.5 Any equipment placed between the front seats should not be higher than the bottom seat cushion for the entire length of the cushion.

3.1.1.6 Manufacturers shall specify brackets, hardware and mounting locations to be used to meet this standard in their installation guide or owner's manual.

- 3.1.2 All controls and components should be located and designed to minimize driver distraction.
  - 3.1.2.1 The control pad should be designed and organized to minimize officer workload. The record button should be readily identifiable by size, color, location and/or other design features. The record button should be easily accessible by officers wearing gloves.
  - 3.1.2.2 All controls should be easily activated by a wide range of officers/operators. Reach requirements shall correspond to guidelines set forth by the Society of Automotive Engineers for the placement of automotive controls. The reach range shall correspond to the 10% female through the 90% male sizes.
  - 3.1.2.3 All cameras should default to auto focus. The manufacturer may provide an auto focus override system if desired. The override system should be configurable to prevent operation while the vehicle is in motion.
  - 3.1.2.4 System components shall be capable of being illuminated for ready identification during periods of darkness. Backlit controls are preferred. The illumination level shall be capable of being controlled over a range from bright to dark. The illumination level shall be set by either a discrete control within the unit itself or by linking to the vehicle dash illumination control. The viewing screen light level shall be controlled simultaneous with the controls or independently. The viewing screen shall be capable of being completely dimmed. The operator must have the ability to blackout the system on demand.
  - 3.1.2.5 Only monitoring of information being or capable of being recorded should be displayed on the viewing screen while the vehicle is in motion. Viewing of previously recorded or externally supplied digital asset should not be allowed while the vehicle is in motion.
- 3.1.3 Installed equipment shall be located to minimize interference with the view of the driver.
  - 3.1.3.1 Installed equipment shall be located to minimize interference with the view of the front seat passenger.
  - 3.1.3.2 No item other than the camera shall, extend below the AS-1 line. This line has been determined in Federal Motor Vehicle Safety Standard 205 [October 1, 2002] *Glazing Materials* (ANSI/SAE Z26.1) (See Appendix B) to be the minimum vertical sight line necessary for safe vehicle operation. It can commonly be located on the vehicle at the bottom of the factory-installed tint band at the top of the windshield. At one or both sides of the windshield near the "A-pillar" is a printed designation visible from outside the vehicle marked "AS-1". To ensure safe vehicle operation, equipment located in other locations

shall not impair the driver's view to the front, sides or rear of the vehicle. Alternatively, a manufacturer may elect to perform the SAE tests for vertical visibility that determine the AS-1 line if they want to extend below this line at locations rearward of the windshield. The minimum height for eye level above the seat cushion will be as determined for an SAE 90% male model.

- 3.1.3.3 No part of any equipment in the interior of the passenger compartment will obscure for the 10% female through the 90% male SAE sizes any speedometer, warning lights, gauges, essential controls, or mirrors placed in the vehicle by the original equipment manufacturer. Further, no installed equipment will interfere with the operation of vehicle controls such as the transmission shifter, headlamp controls, windshield wipers, electric door locks, window defroster controls, etc. See Federal Motor Vehicle Safety Standards 101[October 1, 2002], "Controls and Displays" for a complete list of included devices. (See Appendix C). This does not include controls for convenience items, such as a commercial broadcast radio.
- 3.1.3.4 Manufacturers shall specify equipment-mounting locations to comply with this specification in their installers guide or owner's manual, or will provide a list of vehicles for which the vendor's systems will meet this specification.
- 3.1.4 Installed equipment shall be properly fused to minimize shock and fire hazards.
  - 3.1.4.1 All wiring shall meet industry standards applicable to the wire application. For example, wiring and electronic components contained within the system housings such as the camera body, control panel body and monitor meet applicable Underwriters Laboratory (UL) standards for gauge, insulation type, fusing, connectors, heat sinks, etc. Wiring exterior to these components will meet all applicable Society of Automotive Engineers (SAE) standards for gauge, insulation type, fusing, connectors, etc.
  - 3.1.4.2 All systems shall be properly grounded using the same industry standards as 3.1.4.1 above and if necessary, due to the presence of hazardous voltage or amperage levels, shall be equipped with ground fault interrupters to prevent shock and electrocution hazards. Properly grounded equipment will also provide the most reliable service for the user and minimize many sources of Electromagnetic Interference.
  - 3.1.4.3 Manufacturers shall provide information in their installer's guide or owner's manual that specifies the proper wiring, fuses, connectors, connection points with the vehicle electrical system and grounding points.
- 3.1.5 Elimination of hazardous pinch points.
  - 3.1.5.1 Doors, brackets or any other moving part shall be designed so that fingers or hands cannot be pinched and injured when the parts are moved.

3.1.5.2 Manufacturers shall use any recognized standard from the following sources that addresses this issue: Federal Motor Vehicle Safety Standards, Society of Automotive Engineers, Underwriters Laboratory, and Consumer Product Safety Commission.

**3.2 No parts that can come into contact with human skin shall be allowed to reach a temperature capable of causing a burn injury, Reference UL 60950 "Safety of Information Technology Equipment" as amended December 1, 2000. Items carried on the officer's person or uniform shall not pose an undue risk of injury.**

3.2.1 Any system component carried on the officer's person shall meet all Underwriters Laboratory Standards for shock/electrocution and burn prevention. All batteries used in such devices shall meet Underwriters Laboratory Standards for safety.

3.2.2 The manufacturer shall provide a warning that components and controls shall not be placed on the officer's person so that it prohibits free access to and removal of firearm, baton, Pepper Spray, handcuffs, etc. The following proposed statement should be prominent in the owner's manual.

**"Placement of items on the duty belt can restrict ready access to important equipment.** The location of the wireless transmitter or any other device provided with this system that is carried on the officer's person should be chosen with care and consideration. After a location is selected, the officer should test access to and practice drawing primary items such as service firearms and secondary defense devices such as Aerosol Subject Restraint, Batons, Electronic Disruption Devices, etc. Proper operation of handheld radios and other signaling devices should also be tested as should access to handcuffs and other restraining devices."

3.2.3 Any body-worn cords or wires shall be of such construction that they minimize the risk of strangulation or cause injury from strangulation, cutting off of blood flow or laceration during assault, slip, fall or other types of incidents or during a vehicle crash.

3.2.4 Any component worn or carried by the officer shall be of smooth construction properly rounded or chamfered to minimize the possibility of injury. The components shall be free of sharp points or edges that could cause injury during a fight, slip, fall or other types of incidents. In addition all clips and retention devices should be designed to minimize the possibility of pinch points that could cause injury.



### **3.3 Location of Data Storage**

- 3.3.1 This specification does not require a specific location. However, if mounted in the passenger compartment it shall meet all safety requirements in section 3.1 above.
- 3.3.2 If located in the trunk, the component shall meet all requirements for wiring and safety above. In addition, it shall be constructed, located and mounted in such a way that the device will not become a hazard to the vehicle fuel system or passengers forward of the system in a collision.

### **3.4 Record indicators**

- 3.4.1 A system should have an illuminated record indicator readily visible to persons outside the vehicle to the front and passenger side that indicates when the system is actively recording. This indicator does not need to be visible to occupants inside the vehicle. This record indicator shall comply with 3.1.2.4.
- 3.4.2 Unmarked patrol vehicles and surveillance vehicles may be exempt from this requirement depending on local laws and policy requirements.

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## **Section 4 - General Mobile Video System Specifications**

**4.1** The mobile video system shall consist of a camera, a recording mechanism, control center, monitor, wireless microphone/transmitter system to capture audio outside of the vehicle for traffic stops, and a hard-wired microphone to capture audio from inside the police vehicle.

**4.1.1** Emphasis should be placed on the video system's ability to maintain consistent audio/visual recording quality, while subject to interference from the following sources (See Appendix D for applicable UL Standards Reference):

- a) High-powered television stations
- b) Other radio frequency interference (including UHF, VHF and HF transmitters.)
- c) Automobile alternator, ignition, and electrical systems
- d) Automobile heaters / air conditioner fan motors
- e) Other patrol vehicle electrical systems to include radios, emergency lights, siren, mobile data computers, and speed measuring devices
- f) High voltage power lines, traffic signals, neon signs, etc.

**4.1.2** When in operation, the mobile video system must not generate electromagnetic or radiation that interferes with communications or other electronic equipment found within a police vehicle.

**4.1.3** Programming of the in-car recording system shall be restricted to authorized personnel only through the system controller.

**a. Electronic Conditions**

- i. The in-car recording system shall be protected from damage due to input of voltage, reverse polarity, and electrical transients that may be encountered.
- ii. All programmable parameters shall be contained in non-volatile memory.
- iii. Loss of power to the system shall not result in the unit requiring reprogramming. Sudden loss of power shall not cause loss of any recorded data.

## **4.2 Front-Facing/Primary Camera**

**4.2.1** Dimensions should be consistent with Officer Safety Section 3.1.

**4.2.2** The camera shall operate within the range of temperatures from 0 to 120 degrees Fahrenheit and/or between -18 to 40 degrees Celsius.

- 4.2.3 The Camera and lens will be equipped with auto focus, automatic exposure, and automatic white balance.
- 4.2.4 The camera shall have a backlight compensation setting.
- 4.2.5 The camera shall be a solid state imaging system that shall not be subject to burn in, or interference by magnetic fields. (Refer to the ETATS document)
- 4.2.6 The camera shall have a minimum color resolution of 450 horizontal lines.
- 4.2.7 The camera shall be capable of being rotated 180 degrees on a horizontal plane in either direction on its mount without having to loosen any screws or knobs.
- 4.2.8 The color camera shall be capable of providing an image consistent with the minimum requirements listed in 6.3.2.
- 4.2.9 The camera shall operate on a filtered power source, regulated, and short-circuit-protected. The voltage supplied to the camera shall meet the manufacturer's specification and shall not vary with fluctuations of the system's electrical system voltage of between 9 and 18 volts.
- 4.2.10 The camera shall provide a minimum field of view of 24 feet width at distance of 35 feet (40 degrees).
- 4.2.11 The camera should provide both automatic and manual focus capabilities, which are user selectable.
- 4.2.12 The camera shall offer a signal-to-noise ratio of at least 46db.

### **4.3 Video Monitor**

- 4.3.1 The monitor must be at least a 3 inch (diagonally measured) color monitor.
- 4.3.2 The monitor shall operate between 32 and 120 degrees Fahrenheit and/or between 0 and 49 degrees Celsius.
- 4.3.3 The monitor shall be capable of displaying a live picture from the camera when the system is on (even if recording is not in progress).
- 4.3.4 The system shall include a system speaker to provide monitoring of live audio from the portable transmitter microphone and from recorded sounds during the playback mode. The system shall contain a readily accessible control to enable and disable monitoring of live audio.
- 4.3.5 The system shall have a volume control, which will allow the user to adjust audio

level and turn off sound if desired.

4.3.6 The recording device shall operate independently of the monitor.

4.3.7 The monitor should have the capability to display: date/time, user identification information, emergency light indication, siren indication, braking indicator and microphone activation indicator.

4.3.8 The monitor shall operate on a filtered power source, regulated, and short-circuit-protected. The voltage supplied to the monitor shall meet the manufacturer's specification and shall not vary with fluctuations of the system's electrical system voltage of between 9 and 18 volts.

#### **4.4 Audio - Wireless Transmitter:**

4.4.1.1 Range of 1000 feet with line of sight at ideal conditions

4.4.1.2 Transmitter: internal antenna

4.4.1.3 Operator shall have the ability to deactivate audio from remote audio transmitter, but NOT disable video recording.

4.4.1.4 Activate audio and video from remote audio transmitter

4.4.1.5 Redundant microphone built-into audio transmitter

4.4.1.6 Use of FCC-approved frequency bands

4.4.1.7 Digital transmission to ensure clarity of audio without distortion throughout the range of the transmitter (Use of spread spectrum technology is recommended).

4.4.1.8 Audio transmitter shall be able to be synchronized to receiver in the vehicle.

4.4.1.9 Rechargeable battery standby (15 hrs minimum) and talk time (3.5 hrs minimum).

#### **4.5 Camera/Mobile Digital Video Recorder (MDVR) Controls:**

##### **4.5.1 Controls**

- a) Power on/off
- b) Play
- c) Record start/stop
- d) Fast Forward
- e) Rewind
- f) Stop
- g) Pause

**4.5.2 Camera Controls, if not easily accessible on camera:**

- a) Zoom in/out
- b) Auto Focus on/off
- c) Backlight Compensation

**4.5.3 Indicators:**

- a) System Power on
- b) Microphone on
- c) Media inserted and operational with remaining capacity/time available
- d) Recording
- e) Fast Forward
- f) Stop
- g) Time Counter
- h) Diagnostic Indicator

**4.5.4 The recording functions shall be activated by any of the following modes:**

- a) User pushes record button.
- b) Activation of the emergency lights and/or sirens.
- c) User activates the record button on the wireless microphone transmitter.

## **Section 5 - Security Features**

**5.1** The in-car recording system shall have the capability to restrict access to the programming functions, including but not limited to time/date features.

**5.2** The recording device must have the capability of preventing the user from erasing and recording over previously recorded information from either inside the vehicle or at the recording device controls.

### **5.3 Vehicle Recording System Integrity**

**5.3.1** Integrity of vehicle recording systems refers to the validity of the digital asset captured by the system, in which the system limits the potential for errors.

**5.3.1.1** The Active and Archival Storage systems shall provide a mechanism for backing-up digital assets.

**5.3.1.2** The Active and Archival Storage systems should utilize fault tolerant storage or similar technology.

**5.3.1.3** User interfaces should prevent the input of invalid data.

### **5.4 Consistency**

#### **5.4.1 Time Consistency**

**5.4.1.1** Time stamping in whatever format offered or selected, shall be consistent within all system components.

**5.4.1.2** The Vehicle's recorder clocks should be synchronized to the Active and Archival Storage System within 0.5 seconds, when the vehicle recorders have electronic connectivity to the storage systems. The manufacturer should provide evidence that system components are synchronized in time.

**5.4.1.3** Metadata, including time stamping, shall remain accurate with respect to the recording as it was captured, despite any time sync irregularities in a secondary unit, archival system, or viewer.

**5.4.1.4** Time-stamping between the components of the digital asset shall be consistent and maintained. This must be verifiable by a means offered by the manufacturer.

**5.4.1.5** Each component in the system maintaining an independent clock shall contain a mechanism to backup the clock for a minimum of fourteen days in the case of primary power failure to the component.

#### **5.4.2 Digital Asset Consistency**

The inclusive subsystems within the overall system shall be able to recognize and move data interchangeably. This is in correlation with any recommendations included in the authenticity section of this document.

#### **5.4.3 Subsystem Consistency**

The components within the system from different manufacturers shall be in compliance with technical recommendations as indicated in this document. To ensure consistency of the digital asset, routine maintenance and repair should be done based upon manufacturer recommendations.

### **5.5 Authenticity**

#### **5.5.1 Authenticity of individual access**

##### **5.5.1.1 In-Car System**

5.5.1.1.1 The recorder shall identify the vehicle in which the recorder is mounted.

#### **5.5.2 Authenticity of equipment**

##### **5.5.2.1 Officer Assignment**

5.5.2.1.1 Removable Media shall indicate the badge number of the officer assigned to the media or the vehicle ID and the officer assigned to transfer the media, if applicable, and the Media ID.

5.5.2.1.2 Non-Removable Media shall indicate the badge number of the officer or the vehicle ID and the officer assigned to transfer the media, if applicable, and shall be related to a specific digital asset.

5.5.2.1.3 Optionally the officer and the officer assigned to transfer the media, if applicable, may log into system and validate that the equipment is operating properly.

##### **5.5.2.2 Physical Security of the Recorder**

5.5.2.3 During system Initlation, the system should have the capability to visually indicate to the officer if the system has been tampered with.

#### **5.5.3. Authenticity of Recorded Material**

5.5.3.1 The Vehicle Video Capture System shall provide a mechanism to capture the time and date of the recording. The time and date of the recording shall become part of the Chain of Custody Audit Log associated with Type 1 and Type 2 recordings.

5.5.3.2 The Active Storage System shall be able to include the Media ID of any removable media used to transfer the digital asset from the Vehicle Video



Capture System. The Media ID shall become part of the Chain of Custody Audit Log of Type 1 recordings.

5.5.3.3 All Type 1 digital asset recording systems using electronic transfer of the recorded material shall have an automated authentication mechanism. Digital asset authentication shall be attached to the digital asset sequence when first recorded. The video recording equipment shall use a digital signature that has been standardized and approved by the American Bar Association (ABA) [Digital Signature Guidelines, Information Security Committee, Electronic Commerce & Infrastructure Technology Division, of the American Bar Association. 1996.]

5.5.3.4 Prior to the electronic transfer of Type 1 digital assets, metadata shall be attached.

## **5.6 Transfer of Digital Assets**

The Archive and Active Storage systems shall provide a chain of evidence report detailing all Digital Assets activity listed below.

### **5.6.1 Physical Digital Asset Transfer Using Removable Media:**

5.6.1.1 The Chain of Custody Audit Log shall contain a Media Identification Number consistent with operating agency policy.

5.6.1.2. An Integrity check shall be used to validate that the digital asset on the Active Storage is an accurate copy to any data on the removable storage media prior to the clearing of data on the removable storage media.

5.6.1.3 The Chain of Custody Audit Log for Type 1 digital asset included on the Active Storage System shall contain the following items when the digital asset on a removable media device (e.g., Spinning Optical, Flash, Digital Tape, or Removable Magnetic) is transferred to Active Storage:

- a) Name or ID (badge number or employee number) of officer or person submitting digital asset for transfer;
- b) Media identification number (if tracked by the department);
- c) Number of "copies" made to other media (e.g., Tape, Spinning Optical Media, Other server storage location);
- d) Retention period for digital asset;
- e) Integrity check performed to validate that the digital asset transferred to the active storage is an accurate copy prior to any clearing of data on the removable storage media.

### **5.6.2. Wireless Data Transfer:**

5.6.2.1. An Integrity check shall be used to validate that the digital asset on the Active Storage is an accurate copy to any data on the recorder prior to the information being deleted from the recorder.

### **5.6.2.2 Wireless Transfer Network Topology:**

5.6.2.2.1 A wireless network used to transfer the digital asset from the recorder to Active Storage shall, at a minimum, use 128-bit encryption to create a secure connection for the digital assets to be transferred. Manufacturers, at their customers' discretion, may provide other security technologies that surpass 128-bit encryption. See Section 8.9.3 for more information on additional forms of digital asset protection.

5.6.2.2.2 IEEE standards based wireless networking equipment shall use the following security guidelines:

- a) Customized network name;
- b) Disabled SSID/ESSID (Network Name) broadcast; and
- c) 128-bit RC4 link encryption.

Additional security standards which exceed those set by the standards listed above may be applied to the wireless link as defined by the customer or manufacturer.

5.6.2.2.3 If a non-IEEE standards based wireless networking equipment is used, it should be configured to at least meet the equivalent minimums defined in 5.6.2.2.1 and 5.6.2.2.2.

### **5.6.2.2.4 Audit Trail Items on the Active Storage**

The Chain of Custody Audit Log for Type 1 digital assets included on the Active Storage System shall contain the following items when wireless (automated) digital asset transfer from the recorder to Active Storage is used:

- a) Successful wireless connection with recorder made;
- b) Time/date of transfer;
- c) Number of "copies" made to other media (e.g., Tape, Spinning Optical Media, Other server storage location);
- d) Retention period for digital asset;
- e) Integrity check performed to validate that the digital asset transferred to the server is an accurate copy prior to any clearing of data on the recorder storage medium.

### **5.6.3. Wired Data Transfer:**

5.6.3.1 An Integrity check shall be used to validate that the digital asset on the Active Storage is an accurate copy to any digital asset on the recorder prior the information being deleted from the recorder.

### **5.6.3.2 Wired transfer network topology:**

5.6.3.2.1 A private network (i.e., separate from any other networks) used to transfer the digital assets from the recorder to Active Storage shall be considered secure

since it is limited in its scope and is restricted from being accessed by any device except for the recorder and the Active Storage server.

5.6.3.2.2 A public network (i.e., where the data must cross over another non-private network) used to transfer the digital asset from the recorder to Active Storage or between Active Storage and Archival Storage shall, at a minimum, use 128-bit encryption to create a secure connection for the digital assets to be transferred. Manufacturers, at their customers' discretion, may provide other security technologies that surpass 128-bit encryption. See Section 8.9.3 for more information on additional forms of digital asset protection.

#### **5.6.3.3 Audit Trail Items on the Active Storage**

The Chain of Custody Audit Log for Type 1 digital assets included on the Active Storage System shall contain the following items when wired (automated) digital asset transfer from the recorder to Active Storage is used:

- a) Successful wired connection with recorder made;
- b) Time/date of transfer;
- c) Number of "copies" made to other media (e.g., Tape, Spinning Optical Media, Other server storage location);
- d) Retention period for digital assets;
- e) Integrity check performed to validate that the digital assets copied to the server is an accurate copy prior to any clearing of data on the removable storage medium.

#### **5.6.4 Transfer from Active Storage to Archival Storage**

The Chain of Custody Audit Log for Type 1 digital asset shall contain the following items when the digital asset is transferred from Active Storage to Archival Storage:

- a) Name of System Administrator initiating the transfer (if process is not automated);
- b) Time/date of transfer;
- c) Retention period for digital assets;
- d) Integrity check performed to validate that the digital asset transferred from Active Storage to Archival Storage is an accurate copy prior to clearing of Active Storage.

#### **5.6.4.1 Retrieval of Digital Assets from Archival Storage back to Active Storage**

The Chain of Custody Audit Log for Type 1 digital assets shall contain the following items when the digital asset is transferred from Archival Storage to Active Storage:

- a) Name of System Administrator initiating the transfer (if process is not automated);
- b) Time/date of transfer;
- c) Retention period for digital assets;

- d) Integrity check performed to validate that the digital assets transferred back to Active Storage is an accurate copy should the digital assets stored in Archival Storage be removed.

#### **5.6.4.2 Retrieval of Digital Assets**

The Chain of Custody Audit Log for Type 1 digital assets shall contain the following items on retrieval of data from Active or Archival Storage for replication onto departmentally accepted media (e.g., Spinning Optical, Flash, Digital Tape, or Removable Magnetic) for presentation in court or other official capacity:

- a) Name of System Administrator or designated personnel requesting digital asset for export;
- b) Time/Date of export;
- c) Retention period for digital assets;
- d) Integrity check to validate that exported copy is an accurate copy of original digital asset in Active or Archival Storage.

5.6.5 The Chain of Custody Audit Log for Type 1 digital assets shall contain the date, time and an identifier that indicates the digital assets removed.

#### **5.6.6 Physical storage and archival of removable non-WORM media**

5.6.6.1 If the MVS records on removable media and the removable media is the Archival System, then the Chain of Custody Audit Log for Type 1 digital assets shall contain an indication if the digital asset on the removable non-WORM media has been transferred to Active Storage (e.g., is the digital asset on the removal non-WORM media marked as "deleted"?).

5.6.6.2 An Integrity check shall be used to validate that the digital asset on the Active Storage is an accurate copy of any data on the removable storage media prior to setting the deleted indication.

### **5.7 Physical Security**

#### **5.7.1 In-Car Equipment Security**

The following items shall be included to protect the vehicle's recording media:

#### **5.7.2 Equipment diagnostics**

5.7.2.1 When powered, the recorder shall perform a self-test to insure complete functionality. If the recorder does not pass the self-test, it shall immediately notify the user.

5.7.2.2 The recorder shall be able to monitor itself while in operation. Should a component of the recorder fail while in operation, the recorder shall immediately notify the user.

5.7.2.3 The recorder shall provide the following media diagnostics:

- a) Indicate amount of storage space remaining on media; and
- b) Send a notification to the user (audible/visual) that storage is reaching its maximum capacity.

### **5.7.3 Equipment Enclosure**

5.7.3.1 Recording device shall be physically mounted in the vehicle, following the manufacturer's recommendations, to prevent removal without tools and deter theft of the device.

5.7.3.2 If removable, the recording device shall, at a minimum, be secured using a physical lock that prevents unauthorized removal of recorder from the vehicle. A key is required to unlock the recorder for removal from the vehicle.

- a) Keys to the physical lock can include but are not limited to:
  - i. A typical key, though one that can not be easily duplicated (cylindrical key, etc.)
  - ii. A "credit card" style magnetic strip that can be "swiped" to release the lock.
  - iii. An electronic "chip" which will release the lock when placed into proximity of a specific sensor.

### **5.7.4 Removable Media Security**

5.7.4.1 The recording media shall be secured using a locking mechanism that prevents unauthorized removal of the storage media from the recorder.

5.7.4.2 The recording device shall indicate when media is inserted into the recorder

5.7.4.3 A key shall be used to unlock the recording media for removal from the recorder. Examples of the type of keys that may be used to secure the recording media are but not limited to:

- a) A physical key, though one that can not be easily duplicated (e.g., cylindrical key);
- b) A "credit card" style magnetic strip that can be "swiped" to release the lock;
- c) An electronic "chip" which will release the lock when placed into proximity of a specific sensor; or
- d) A password that is entered into the recorder.

5.7.4.4 Non-removable recording media shall be housed inside the recorder to prevent tampering with and/or destruction of the media.

5.7.4.5 The manufacturer shall provide guidelines on the media life cycle of the digital asset.

5.7.4.6 Removable media shall contain the following items and markings:

- a) Tamper detection process;
- b) Damage protection; and
- c) The media must be marked on the exterior with an identifying number or markings that identify each media and makes that media unique.

## **Section 6 – Digital Asset Recording**

**6.1** The digital assets recorded shall accurately and reliably reproduce the viewed imaged, observed sound and associated metadata as the *Type 1 Digital Asset*.

**6.1.1** The in-car system shall be capable of recording events uninterrupted for a minimum of three and a half hours (3.5) hours at a minimum resolution of 640x480 (VGA) and a minimum frame rate of 29.97 frames per second (fps).

**6.1.2** The *1<sup>st</sup> instance / primary image* shall conform to accepted and known industry standards. (See Appendix D for applicable UL Standards Reference).

**6.1.3** *1<sup>st</sup> instance / primary image* shall use a HASH verification process to certify the authenticity of the digital asset(s) consistent with Section 5 of this document.

**6.1.4** The in-car system shall be capable of capturing a forty degree horizontal field of view as part of the digital asset known as *1<sup>st</sup> instance / primary image* full motion video.

**6.2** The exchange of the digital assets from the in-car system, active system, and archival storage system can be done in various ways. To that end all systems shall conform to the following:

- a) All electronic transfers / exchanges between the in-car recording system, and the active, or archival storage system along with any subsequent electronic transfers or exchanges of the *Type 1 Digital Asset* between the active and archival systems shall be lossless and shall be done with a HASH verification process. The HASH verification process shall be consistent with Section 5 of this document.
- b) All digital assets known as the *Type 1 Digital Asset* and accompanying audio tracks shall be capable of being rendered to a uncompressed file in industry standard file format. The associated metadata shall be transcoded into a file in standard file format.
- c) All digital assets known as the *Type 1 Digital Asset* along with their accompanying audio tracks and associated metadata in an active storage system shall be capable of being rendered to a proxy Microsoft's Windows Media File format (WMV).

### **6.3 Interim Evaluation Tests**

At the time of publication of this document, the National Institute of Standards (NIST) is working on but has not yet finalized a set of standards for testing in-car digital recording systems. The following subjective tests can be used for the evaluation of all in-car digital recording systems.

6.3.1 Daytime Evaluation – Optimal Lighting via Natural Sunlight.

- a) License plate testing. License plate is defined as a plate with either raised or stamped lettering and a plate that has a smooth or computer applied lettering.
  - i) The license plate testing is established by placing one vehicle behind another at a distance of eighteen (18) feet from the front bumper of the patrol car to the rear bumper of the vehicle in question. This testing could also be accomplished by placing a series of plates on a static display at the eighteen (18) foot mark from the front bumper of the patrol vehicle.
  - ii) The System shall be capable of accurately and reliably recording and playing back license plate(s) identification alphanumeric characters used in the test.
  - iii) All tests shall have in addition to the digital assets collected by in-car system a still picture(s) taken by a stand-alone camera for verification of the license plates identification alphanumeric characters.
- b) Air Force Standard Chart Testing. The Air Force Standard Charts (AFSC) will be provided by the IACP for testing.
  - i) The AFSCs shall be placed at a distance of thirty-five (35) feet from the front bumper of the patrol car vehicle.
  - ii) The system shall be capable of accurately and reliably recording and playing back AFSCs used in the test.
- c) NHTSA Walk and Turn and One Leg Stand Testing. The standard field sobriety tests shall be conducted in accordance with the NHTSA manual. Instructions will be provided for the conducting of these tests by IACP.
  - i) The Walk and Turn test shall be conducted beginning at a location that is 18' in front of the patrol car's front bumper. The individual performing the test shall start walking away from the patrol car. The person shall conduct this test on an imaginary line that is extended forward from both the left and right sides of the patrol car.
  - ii) The One Leg Stand will be conducted with the person facing the camera standing at the 24' mark from the patrol car's front bumper. The person shall conduct this test on an imaginary line that is extended forward from both the left and right sides of the patrol car.
  - iii) The system shall be capable of accurately and reliably recording and playing back these tests.
- d) Sports Ball Tests. The balls to be used for this test shall be a collegiate football, a size five (5) black and white soccer ball, a softball, a baseball and a golf ball.
  - i) The test will be conducted in the following manner and will be repeated with each of the balls specified above;



- ii) A standard passenger car will be parked eighteen (18) feet in front of the patrol car measured from the front bumper of the patrol car to the rear bumper of the subject car.
- iii) An average height person will sit in the driver's seat of the subject car.
- iv) The "driver" will place a ball in their right hand. The "driver" will place their upper arm parallel to the ground and move the ball from an extended arm position to near their shoulder three times at a cycle time of approximately one second per extended/shoulder/extended cycle.
- v) After completing the third cycle while the ball is near the shoulder the "driver" will quickly throw the ball out the passenger window.
- vi) This test shall be repeated three times with each ball.
- vii) The system shall be capable of accurately and reliably recording and playing back these tests.

6.3.2 Nighttime Evaluation will be conducted indoors or out in an area with no additional lighting over that provided by the patrol car. The patrol car lights will be as follows:

- a) The bright headlamps shall be on.
- b) A standard Unity A-pillar spotlight shall be on and aimed at the center of the back window of the subject car.
- c) Two halogen takedown lights of 50 watts each mounted on the roof as in a standard police bar light shall be activated as well.

The following tests shall be conducted:

- a) Air Force Standard Chart Testing. The Air Force Standard Charts (AFSC) will be provided by the IACP for testing.
  - i) The AFSCs shall be placed at a distance of thirty-five (35) feet from the front bumper of the patrol car vehicle.
  - ii) The system shall be capable of accurately and reliably recording and playing back AFSCs used in the test.
- b) NHTSA Walk and Turn and One Leg Stand Testing. The standard field sobriety tests shall be conducted in accordance with the NHTSA manual. Instructions will be provided for the conducting of these tests by IACP.
  - i) The Walk and Turn test shall be conducted beginning at a location that is 18' in front of the patrol car's front bumper. The individual performing the test shall start walking away from the patrol car. The person shall conduct this test on an imaginary line that is extended forward from both the left and right sides of the patrol car.
  - ii) The One Leg Stand will be conducted with the person facing the camera standing at the 24' mark from the patrol car's front bumper. The person shall conduct this test on an imaginary line that is extended forward from both the left and right sides of the patrol car.

- c) The Sports Ball Tests. The balls to be used for this test shall be a collegiate football, a size five (5) black and white soccer ball, a softball, a baseball and a golf ball.
  - i) The test will be conducted in the following manner and will be repeated with each of the balls specified above;
  - ii) A standard passenger car will be parked eighteen (18) feet in front of the patrol car measured from the front bumper of the patrol car to the rear bumper of the subject car.
  - iii) An average height person will sit in the driver's seat of the subject car.
  - iv) The "driver" will place a ball in their right hand. The "driver" will place their upper arm parallel to the ground and move the ball from an extended arm position to near their shoulder three times at a cycle time of approximately one second per extended/shoulder/extended cycle.
  - v) After completing the third cycle while the ball is near the shoulder the "driver" will quickly throw the ball out the passenger window.
  - vi) This test shall be repeated three times with each ball.
  - vii) The system shall be capable of accurately and reliably recording and playing back these tests.

**6.4** The recording system shall interface with the vehicle emergency lights and/or siren currently installed in the vehicle, and may be activated by all of the following modes: 1) User pushes the record button; 2) Activation of the emergency lights and/or siren; and 3) User activates the record button on the wireless transmitter.

**6.5** The recording system should activate during an accelerometer event (to be designated by departmental policy).

**6.6** The system's timekeeping device and the vehicle's identifier shall be protected by a system battery backup to prevent loss of information in the event the vehicle battery is disconnected for up to a minimum of fourteen (14) days.

#### **6.7 System/Metadata**

**6.7.1** All metadata shall be capable of being super-imposed or absent on the screen during playback mode.

**6.7.2** Recommended: ability to support enabled or disabled audio capture by system administrator for pre-event and post-event buffered/recorded video, along with backend evidence preparation/export tools for playback in court.

## **Section 7 - Data Point for Interoperability**

### **7.1 Active or Archival Storage Server**

Interoperability shall begin after the transfer of the digital asset from the mobile digital video recording unit located in the field. Access and availability should be granted in order to conduct the sharing of the digital asset at this prescribed data point within the capture, transfer and archival process.

### **7.2 Types of Interoperable Exchange**

#### **7.2.1 Two levels of Interoperable Exchange**

There shall be at least two Interoperable Digital Assets obtained from the Active or Archival Storage Server.

##### **7.2.1.1 Type 1 Interoperable Digital Asset**

The video, audio, and associated data that meet the criteria as defined by Section 6.2.b shall serve as the evidentiary digital asset.

##### **7.2.1.2 Type 2 Interoperable Digital Asset**

The video, audio, and associated data identified as the proxy in Section 6.2.c shall serve as the interoperable digital asset.

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## **Appendices**

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**Appendix A**

**Recommended Policies  
and Best Practices**

## **Appendix A – Recommended Policies and Best Practices**

**1.1** All mobile video systems shall be of industrial/commercial grade. No prototype models will be considered for testing.

### **1.2 Requirements**

**1.2.1** The mobile video system (in-car camera) shall have a proven, reliable record in actual vehicular use under a variety of conditions. This record shall be evidenced by either manufacturers' testing results, or filed testing results by other law enforcement agencies.

**1.2.2** The vendor must have experience in manufacturing and supporting such systems to include provisions for parts and service as needed.

**1.2.3** The vendor shall provide business and financial history upon request.

**1.2.3.1** Vendors that do not manufacture the components comprising the video system shall be authorized by the original component manufacturer to resell such components. A copy of a factory-authorized dealer certificate shall be provided.

**1.2.3.2** The basic design of all equipment shall be in full production, no prototype models will be considered.

**1.2.3.3** All components of the system must comply with Federal Communications Commission (FCC) standards.

**1.2.3.4** To document vendors' experience in the manufacture, sales, and support of mobile video systems, the vendor shall list agencies to which mobile video systems were sold. Letters of reference for verification should be included.

#### **1.2.4 Sample and Demonstration:**

Prior to award, the agency reserves the right to require any bidder to provide complete video systems of the exact configuration offered for the purposes of evaluation to determine compliance with the specification requirements.

**1.2.4.1** Any mobile video system may be field and laboratory tested by state or independent laboratories to verify its acceptable level of performance and conformity to specifications.

### **1.3 Warranty Section**

**1.3.1** All camera, recorder, environmental control components, wireless microphones and transmitters, receiver, monitor, and control circuit components, shall be warranted to ensure they are fit for their intended purpose for a minimum of one year.



- 1.3.2 All defective equipment shall be repaired or replaced within the contracted terms of the warranty. Law enforcement agencies should take into consideration the down time of a vehicle placed out of service due to equipment failure.
- 1.3.3 For warranty purposes, the warranty time begins with initial installation of said equipment in the vehicle.

#### **1.4 Vehicle Recording System Integrity**

- 1.4.1 The officer assigned to the vehicle shall log into the recorder prior to the use of the recorder. This login may be through a User Identification and authentication mechanism provided by the recorder or by standing in front of the camera and recording the Officer's image and voice.
- 1.4.2 Before each shift, the officer shall visually verify the equipment has not been tampered with or has been damaged.
- 1.4.3 A Visual "check" of removable media shall be made to ensure no tampering has occurred, tamper seals are in place (similar to tape used to seal evidence envelopes); and no scratch marks are on the storage device.
- 1.4.4 The IACP Model Policy requires the user officer to conduct an operational readiness test of the system prior to the beginning of their tour of duty. If the system is malfunctioning, they shall notify their supervisor and communications. The supervisor shall make the determination as to when and how the system is repaired or in some cases whether to keep the unit in service.

#### **1.5 Active and Archival Storage Systems**

- 1.5.1 The Active and Archival Storage system shall be located in a secured building (e.g., police station) in a room with restricted access (e.g., server room).
- 1.5.2 The Active and Archival Storage system should be cloned at another location.
- 1.5.3 When the media is being transferred to another medium during the back-up, the file should also be stored separately from the main server.
- 1.5.4 Access and authentication to the Active and Archival Storage System shall be governed by the agency's existing policies and procedures and *shall* include additional levels of user authentication prior to granting access
- 1.5.5 Electronic notification shall be provided for each digital asset intended to be removed from Active or Archival Storage at a time prior to removal based on operating agency policy according to the retention period for the digital asset(s).

## **1.6 Removable Media Security**

### **1.6.1 Physical tamper detection.**

- 1.6.1.1 The operator of the recorder shall perform a physical “check” of removable media to ensure no tampering has occurred:
- a) No scratch marks on storage device; and
  - b) Physical tamper detection devices in place.

### **1.6.2 Key Management. Keys shall be managed via agency policies and procedures such as:**

- a) Identification of individual with key to media;
- b) Identification of individual with a “master” key; and
- c) Identification of individual that can replicate keys.

## **1.7 Back Office Equipment Security**

Any space used by the agency to house the Active Storage, Archival Storage, and associated equipment housed in the agency’s back office shall include:

- a) Equipment housed in secured facility with limited employee access.
- b) Secured system access:
- c) System captures standard “audit” information when user logs into system;
- d) System captures number of times user attempts to log into system; and
- e) System user accounts become inoperable if more than three unsuccessful log-on attempts have been made.
- f) System “passwords” governed by agency policy requirements:
  - i. Passwords to user accounts should be changed on a regular basis per departmental policy, though the IACP recommends that the user account passwords to the digital video system be changed every 30 days for enhanced security.
  - ii. Force “character” requirements for passwords, e.g. numeric, alpha, caps, etc.

- 1.7.1 Operational Policy Considerations. These are questions that should be considered when setting operational policy related to the use of the recorder, recorded material, or archive. These considerations are items that support the recommendations in these specifications but are beyond the scope of the minimum recommendations.

## **1.8. Operational Digital Asset Transfer Policy**

- 1.8.1 The agency should have a documented transfer policy with procedures establishing:

- b) How the transfer of the digital asset from the vehicle takes place;
- c) Available storage capacity remaining limit at which point the digital asset should be transferred from the vehicle recorder;

- d) How equipment or removable media keys should be managed via policies and procedures, such as:
  - i. Identification of individual with key to media;
  - ii. Identification of individual with a “master” key;
- e) Identification of individuals who can replicate keys;
- f) Who is allowed to initiate the transfer or handle any removable media;
- g) How to maintain a manual audit trail;
- h) Recommended audit trail metrics for instances when the physical (manual) transfer of the digital asset from the recorder to Active Storage uses a removable media device (e.g., Spinning Optical, Flash, Digital Tape, Removable Magnetic);
- i) A system for establishing the identification (badge number or employee number) of the officer or person submitting the digital asset for transfer. (It is recommend that when a major incident occurs, authorized personnel respond to the scene and take custody of the digital asset.);
- j) Media identification numbering system (if tracked by the department);
- k) The capture of time/date of the transfer;
- l) The capture of the size of the digital asset transferred;
- m) The capture of the number of “copies” made to other media (e.g., Tape, Spinning Optical Media, Other server storage location);
- n) Acceptable retention periods for digital asset;
- o) How integrity checks are to be performed as a means to validate that the digital asset transferred to the active storage as an accurate copy prior to any clearing of digital assets on the removable storage media;
- p) Indicate successful transfer of digital asset capture; and
- q) Dictate how metadata are specifically coordinated and managed, to include where and how a user or may not be permitted access.

1.8.2 Archival policies. How long the digital asset needs to be archived shall be mandated by the agency in accordance with local and state laws. It is an operational and departmental policy that needs to be established

1.8.3 Verification of location of capture of recorded digital assets. Proof of where the digital asset was captured through verification by officer in the stated location.

1.8.4 Electronic check of the Chain of Custody Audit Log on the media.

## **1.9 Manufacturer Considerations.**

Although not part of the minimum recommendations, these are additional areas that should be considered when specifying an Vehicle Video Capture System.

### **1.9.1 Storage Solution**

- What are the methods of digital asset retention offered by the manufacturer?
- Does the manufacturer provide a storage solution that facilitates the removal of the video from the vehicle?
- Types of storage solutions:

- Hard drive;
  - Digital cassette;
  - Optical media;
  - Flash media.
- Transfer Methods:
  - Automatic;
  - Manual;
  - Wireless;
  - Wired.
- Ease of removal of the storage solution.
- Does the manufacturer provide a method to electronically identify when the media is removed from the vehicle recorder and individually logged into the system at the time the media was removed?
- Does the manufacturer's solution provide a method to configure an alert indicating when the maximum storage capacity in the vehicle equipment is being approached?
- Does the manufacturer's Active and Archival Storage systems provide protection against failure of the storage solution?
- Does the manufacturer's vehicular equipment contain mechanisms to minimize the damage to the digital assets in case of vehicle crash, fire, and/or physical abuse?
- Does the manufacturer's equipment contain tamper detection mechanisms?
- Does the manufacturer's equipment contain tamper resistance mechanisms?
- What is the cost-effectiveness of the storage solution?
- What is the shelf life of the storage solution? For a class 1 felony, can the digital asset be kept available for a minimum of 25 years and up to 75 years?
- Does the manufacturer's storage solution indicate when the recorder or removable media is operated outside of the manufacturer's specified temperature range? This indication may be used to determine when to recertify the equipment or replace the storage solution.
- Does the recorder include functionality to track the estimated remaining lifetime of the removable media?
- Does the manufacturer provide a method to electronically identify removable media?

#### **1.9.2 Chain of Custody**

- Does the manufacturer provide physical security for the vehicle equipment?
- Are there mechanisms to prove that the digital asset is original?
- Does the manufacturer include a CPU or Hardware ID of the vehicle recorder in the audit log of the digital asset?
- Is there an ability to indicate where and when digital asset was captured?
- Does the equipment provide electronic validation of location and time synchronization between recorders through use of GPS equipment?
- Is the time and date on the recorders synchronized to the back office equipment?

- Does the manufacture provide evidence that system components are synchronized in time?
- Can the manufacturer provide a recording stream that is not alterable?
- Does the manufacturer provide the capability of assigning individuals authorization to access the media?
- Does the manufacturer provide the capability of protecting the digital asset on removable media so that it cannot be accessed by unauthorized equipment?
- Does the manufacturer provide synchronization between the record streams and telemetry streams from one or more mobile systems for playback?
- Does the manufacturer provide a method for the user of the vehicle recorder to log in and authenticate?

### 1.9.3 Electronic Transfer

- Does the manufacturer provide other security methods?
- Cryptography methods other than 128-bit encryption may be used to create a private network connection for digital asset transfer. Does the manufacturer provide technical documentation to support admissibility hearings if an encryption method other than 128-bit encryption is used?
- Other forms of high security tunnels (e.g., VPN, IKE, PKI, DES, 3DES, IPSec, AES, TKIP) are commercially available and provide security beyond what is provided by 128-bit encryption. At their customers' discretion, manufacturers may provide a higher level of data confidentiality for the transfer of digital assets. Does the manufacturer provide technical documentation to support admissibility hearings that ensures that the link is secure and that the data transfer across the link meets the integrity requirements laid out in these specifications?
- Manufacturers, at their customers' discretion, may also provide encryption of the digital asset using commercially available, or proprietary methods prior to transfer to Active Storage using one. Does the manufacturer provide technical documentation to support admissibility hearings to ensure that the digital asset once decrypted on the other side of the transfer is an accurate copy of the original and meets the integrity requirements laid in these specifications?

## Appendix B

### Federal Motor Vehicle Safety Standards 201 “Occupant Protection in Interior Impact”

## §571.201

## 49 CFR Ch. V (10-1-05 Edition)

smooth wheel having a diameter of 1.70 m  $\pm$  1%.

S6.3.1.2.2 During the test, the ambient temperature, measured at a distance of not less than 150 mm and not more than 1 m from the tire, shall not be less than 38 °C.

S6.3.1.2.3 Conduct the test, without interruptions, at not less than 120 km/h test speed with loads and test periods not less than those shown in the following table:

Test period	Duration (hours)	Load as a percentage of tire maximum load rating
1	4	85%
2	6	90
3	24	100

S6.3.1.2.4 Throughout the test, the inflation pressure is not corrected and the test loads are maintained at the value corresponding to each test period, as shown in the table in S6.3.1.2.3.

S6.3.1.2.5 Allow the tire to cool for one hour after running the tire for the time specified in the table in S6.3.1.2.3, measure its inflation pressure. Inspect the tire externally on the test rim for the conditions specified in S6.3.2(a).

S6.3.2 *Performance requirements.* When the tire is tested in accordance with S6.3.1:

(a) There shall be no visual evidence of tread, sidewall, ply, cord, belt or bead separation, chunking, open splices, cracking or broken cords.

(b) The tire pressure, when measured at least one hour after the end of the test, shall not be less than the initial pressure specified in S6.3.1.

### S6.4 Low Inflation Pressure Performance

#### S6.4.1 Test conditions and procedures.

##### S6.4.1.1 Preparation of tire.

S6.4.1.1.1 This test is conducted following completion of the tire endurance test using the same tire and rim assembly tested in accordance with S6.3 with the tire deflated to the following appropriate pressure:

Tire application	Test pressure (kPa)
P-metric:	
Standard load .....	140
Extra load .....	160
LT:	
Load Range C .....	200
Load Range D .....	260
Load Range E .....	320
CT:	
Standard load .....	170
Extra load .....	180

S6.4.1.1.2 The assembly is conditioned at not less than 38 °C.

S6.4.1.1.3 Before or after mounting the assembly on a test axle, readjust the tire pressure to that specified in S6.4.1.1.1.

##### S6.4.1.2 Test procedure.

S6.4.1.2.1 The test is conducted for ninety minutes at the end of the test specified in S6.3, continuous and uninterrupted, at a speed of 120 km/h (75 mph).

S6.4.1.2.2 Press the assembly against the outer face of a test drum with a diameter of 1.70 m  $\pm$  1%.

S6.4.1.2.3 Apply to the test axle a load equal to 100% of the tire's maximum load carrying capacity.

S6.4.1.2.4 Throughout the test, the inflation pressure is not corrected and the test load is maintained at the initial level.

S6.4.1.2.5 During the test, the ambient temperature, at a distance of not less than 150 mm and not more than 1 m from the tire, is maintained at not less than 38 °C.

S6.4.1.2.6 Allow the tire to cool for one hour. Measure its inflation pressure. Then, deflate the tire, remove it from the test rim, and inspect it for the conditions specified in S6.4.2(a).

S6.4.2 *Performance requirements.* When the tire is tested in accordance with S6.4.1:

(a) There shall be no visual evidence of tread, sidewall, ply, cord, innerliner, belt or bead separation, chunking, open splices, cracking, or broken cords, and

(b) The tire pressure, when measured at least one hour after the end of the test, shall not be less than the initial pressure specified in S6.4.1.

### S6.5 Tire strength.

S6.5.1 *Tire strength for P-metric tires.* Each tire shall comply with the requirements of S5.3 of §571.109.

S6.5.2 *Tire strength for LT tires.* Each tire shall comply with the requirements of S7.3 of §571.119.

S6.6 *Tubeless tire bead unseating resistance.* Each tire shall comply with the requirements of S5.2 of §571.109.

\* \* \* \* \*

## §571.201 Standard No. 201; Occupant protection in interior impact.

S1. *Purpose and scope.* This standard specifies requirements to afford impact protection for occupants.

S2. *Application.* This standard applies to passenger cars and to multipurpose passenger vehicles, trucks, and buses with a GVWR of 4,536 kilograms or less, except that the requirements of S6 do not apply to buses with a GVWR of more than 3,860 kilograms.

### S3. Definitions.

*A-pillar* means any pillar that is entirely forward of a transverse vertical plane passing through the seating reference point of the driver's seat.

*Ambulance* means a motor vehicle designed exclusively for the purpose of

emergency medical care, as evidenced by the presence of a passenger compartment to accommodate emergency medical personnel, one or more patients on litters or cots, and equipment and supplies for emergency care at a location or during transport.

*B-pillar* means the forwardmost pillar on each side of the vehicle that is, in whole or in part, rearward of a transverse vertical plane passing through the seating reference point of the driver's seat, unless:

(1) There is only one pillar rearward of that plane and it is also a rearmost pillar; or

(2) There is a door frame rearward of the A-pillar and forward of any other pillar or rearmost pillar.

*Brace* means a fixed diagonal structural member in an open body vehicle that is used to brace the roll-bar and that connects the roll-bar to the main body of the vehicle structure.

*Convertible* means a vehicle whose A-pillars are not joined with the B-pillars (or rearmost pillars) by a fixed, rigid structural member.

*Convertible roof frame* means the frame of a convertible roof.

*Convertible roof linkage mechanism* means any anchorage, fastener, or device necessary to deploy a convertible roof frame.

*Daylight opening* means, for openings on the side of the vehicle, other than a door opening, the locus of all points where a horizontal line, perpendicular to the vehicle longitudinal centerline, is tangent to the periphery of the opening. For openings on the front and rear of the vehicle, other than a door opening, *daylight opening* means the locus of all points where a horizontal line, parallel to the vehicle longitudinal centerline, is tangent to the periphery of the opening. If the horizontal line is tangent to the periphery at more than one point at any location, the most inboard point is used to determine the daylight opening.

*Door frame* means the rearmost perimeter structure, including trim but excluding glass, of the forward door and the forwardmost perimeter structure, including trim but excluding glass, of the rear door of a pair of adjacent side doors that:

(1) Have opposing hinges;

(2) Latch together without engaging or contacting an intervening pillar;

(3) Are forward of any pillar other than the A-pillar on the same side of the vehicle; and

(4) Are rearward of the A-pillar.

*Door opening* means, for door openings on the side of the vehicle, the locus of all points where a horizontal line, perpendicular to the vehicle longitudinal centerline, is tangent to the periphery of the side door opening. For door openings on the back end of the vehicle, *door opening* means the locus of all points where a horizontal line, parallel to the vehicle longitudinal centerline, is tangent to the periphery of the back door opening. If the horizontal line is tangent to the periphery at more than one point at any location, the most inboard point is the door opening.

*Dynamically deployed upper interior head protection system* means a protective device or devices which are integrated into a vehicle and which, when activated by an impact, provide, through means requiring no action from occupants, protection against head impacts with upper interior structures and components of the vehicle in crashes.

*Forehead impact zone* means the part of the free motion headform surface area that is determined in accordance with the procedure set forth in S8.10.

*Free motion headform* means a test device which conforms to the specifications of part 572, subpart L of this chapter.

*Interior rear quarter panel* means a vehicle interior component located between the rear edge of the side door frame, the front edge of the rearmost seat back, and the daylight opening.

*Mid-sagittal plane of a dummy* means a longitudinal vertical plane passing through the seating reference point of a designated seating position.

*Other door frame* means the rearmost perimeter structure, including trim but excluding glass, of the forward door and the forwardmost perimeter structure, including trim but excluding glass, of the rear door of a pair of adjacent side doors that:

(1) Have opposing hinges;



(2) Latch together without engaging or contacting an intervening pillar; and

(3) Are rearward of the B-pillar.

*Other pillar* means any pillar which is not an A-pillar, a B-pillar, or a rear-most pillar.

*Pillar* means any structure, excluding glazing and the vertical portion of door window frames, but including accompanying moldings, attached components such as safety belt anchorages and coat hooks, which:

(1) Supports either a roof or any other structure (such as a roll-bar) that is above the driver's head, or

(2) Is located along the side edge of a window.

*Roll-bar* means a fixed overhead structural member, including its vertical support structure, that extends from the left to the right side of the passenger compartment of any open body vehicles and convertibles. It does not include a header.

*Seat belt anchorage* means any component involved in transferring seat belt loads to the vehicle structure, including, but not limited to, the attachment hardware, but excluding webbing or straps, seat frames, seat pedestals, and the vehicle structure itself, whose failure causes separation of the belt from the vehicle structure.

*Seat belt mounting structure* means:

(a) A vehicle body or frame component, including trim, that incorporates an upper seat belt anchorage conforming to the requirements of S4.2.1 and S4.3.2 of 49 CFR 571.210, that is located rearward of the rearmost outboard designated seating position, and that extends above a horizontal plane 660 mm above the seating reference point (SgRP) of that seating position; and

(b) A vehicle body or frame component, including trim, that incorporates an upper seat belt anchorage conforming to the requirements of S4.2.1 and S4.3.2 of 49 CFR 571.210, that is located forward of the rearmost outboard designated seating position, and that extends above a horizontal plane 460 mm above the SgRP of that seating position located rearward of the anchorage.

(c) The seat belt mounting structure is not a pillar, roll bar, brace or stiff-

ener, side rail, seat, interior rear quarter panel, or part of the roof.

*Sliding door track* means a track structure along the upper edge of a side door opening that secures the door in the closed position and guides the door when moving to and from the open position.

*Stiffener* means a fixed overhead structural member that connects one roll-bar to another roll-bar or to a header of any open body vehicle or convertible.

*Upper roof* means the area of the vehicle interior that is determined in accordance with the procedure set forth in S8.15.

*Windshield trim* means molding of any material between the windshield glazing and the exterior roof surface, including material that covers a part of either the windshield glazing or exterior roof surface.

#### S4 Requirements

S4.1 Except as provided in S4.2, each vehicle shall comply with either:

(a) The requirements specified in S5, or,

(b) The requirements specified in S5 and S6.

S4.2 Vehicles manufactured on or after September 1, 1998 shall comply with the requirements of S5 and S6.

S5 *Requirements for instrument panels, seat backs, interior compartment doors, sun visors, and armrests.* Each vehicle shall comply with the requirements specified in S5.1 through S5.5.2.

S5.1 *Instrument panels.* Except as provided in S5.1.1, when that area of the instrument panel that is within the head impact area is impacted in accordance with S5.1.2 by a 6.8 kilogram, 165 mm diameter head form at—

(a) A relative velocity of 24 kilometers per hour for all vehicles except those specified in paragraph (b) of this section,

(b) A relative velocity of 19 kilometers per hour for vehicles that meet the occupant crash protection requirements of S5.1 of 49 CFR 571.208 by means of inflatable restraint systems and meet the requirements of S4.1.5.1(a)(3) by means of a Type 2 seat belt assembly at the right front designated seating position, the deceleration of the head form shall not exceed

80 g continuously for more than 3 milliseconds.

S5.1.1 The requirements of S5.1 do not apply to:

- (a) Console assemblies;
- (b) Areas less than 125 mm inboard from the juncture of the instrument panel attachment to the body side inner structure;
- (c) Areas closer to the windshield juncture than those statically contactable by the head form with the windshield in place;
- (d) Areas outboard of any point of tangency on the instrument panel of a 165 mm diameter head form tangent to and inboard of a vertical longitudinal plane tangent to the inboard edge of the steering wheel; or
- (e) Areas below any point at which a vertical line is tangent to the rearmost surface of the panel.

S5.1.2 *Demonstration procedures.* Tests shall be performed as described in Society of Automotive Engineers Recommended Practice J921, "Instrument Panel Laboratory Impact Test Procedure," June 1965, using the specified instrumentation or instrumentation that meets the performance requirements specified in Society of Automotive Engineers Recommended Practice J977, "Instrumentation for Laboratory Impact Tests," November 1966, except that:

- (a) The origin of the line tangent to the instrument panel surface shall be a point on a transverse horizontal line through a point 125 mm horizontally forward of the seating reference point of the front outboard passenger designated seating position, displaced vertically an amount equal to the rise which results from a 125 mm forward adjustment of the seat or 19 mm; and

(b) Direction of impact shall be either:

- (1) In a vertical plane parallel to the vehicle longitudinal axis; or
- (2) In a plane normal to the surface at the point of contact.

S5.2 *Seat Backs.* Except as provided in S5.2.1, when that area of the seat back that is within the head impact area is impacted in accordance with S5.2.2 by a 6.8 kilogram, 165 mm diameter head form at a relative velocity of 24 kilometers per hour, the deceleration of the head form shall not exceed

80g continuously for more than 3 milliseconds.

S5.2.1 The requirements of S5.2 do not apply to seats installed in school buses which comply with the requirements of Standard No. 222, *School Bus Passenger Seating and Occupant Protection* (49 CFR 571.222) or to rearmost side-facing, back-to-back, folding auxiliary jump, and temporary seats.

S5.2.2 *Demonstration procedures.* Tests shall be performed as described in Society of Automotive Engineers Recommended Practice J921, "Instrument Panel Laboratory Impact Test Procedure," June 1965, using the specified instrumentation or instrumentation that meets the performance requirements specified in Society of Automotive Engineers Recommended Practice J977, "Instrumentation for Laboratory Impact Tests," November 1966, except that:

- (a) The origin of the line tangent to the uppermost seat back frame component shall be a point on a transverse horizontal line through the seating reference point of the right rear designated seating position, with adjustable forward seats in their rearmost design driving position and reclining forward seat backs in their nominal design driving position;

(b) Direction of impact shall be either:

- (1) In a vertical plane parallel to the vehicle longitudinal axis; or
- (2) In a plane normal to the surface at the point of contact.

(c) For seats without head restraints installed, tests shall be performed for each individual split or bucket seat back at points within 100 mm left and right of its centerline, and for each bench seat back between points 100 mm outboard of the centerline of each outboard designated seating position;

(d) For seats having head restraints installed, each test shall be conducted with the head restraints in place at its lowest adjusted position, at a point on the head restraint centerline; and

(e) For a seat that is installed in more than one body style, tests conducted at the fore and aft extremes identified by application of subparagraph (a) shall be deemed to have demonstrated all intermediate conditions.

**S5.3 Interior compartment doors.** Each interior compartment door assembly located in an instrument panel, console assembly, seat back, or side panel adjacent to a designated seating position shall remain closed when tested in accordance with either S5.3.1(a) and S5.3.1(b) or S5.3.1(a) and S5.3.1(c). Additionally, any interior compartment door located in an instrument panel or seat back shall remain closed when the instrument panel or seat back is tested in accordance with S5.1 and S5.2. All interior compartment door assemblies with a locking device must be tested with the locking device in an unlocked position.

**S5.3.1 Demonstration procedures.**

(a) Subject the interior compartment door latch system to an inertia load of 10g in a horizontal transverse direction and an inertia load of 10g in a vertical direction in accordance with the procedure described in section 5 of SAE Recommended Practice J839b, "Passenger Car Side Door Latch Systems," May 1965, or an approved equivalent.

(b) Impact the vehicle perpendicularly into a fixed collision barrier at a forward longitudinal velocity of 48 kilometers per hour.

(c) Subject the interior compartment door latch system to a horizontal inertia load of 30g in a longitudinal direction in accordance with the procedure described in section 5 of SAE Recommended Practice J839b, "Passenger Car Side Door Latch Systems," May 1965, or an approved equivalent.

**S5.4 Sun visors.**

**S5.4.1** A sun visor that is constructed of or covered with energy-absorbing material shall be provided for each front outboard designated seating position.

**S5.4.2** Each sun visor mounting shall present no rigid material edge radius of less than 3.2 mm that is statically contactable by a spherical 165 mm diameter head form.

**S5.5 Armrests.**

**S5.5.1 General.** Each installed armrest shall conform to at least one of the following:

(a) It shall be constructed with energy-absorbing material and shall deflect or collapse laterally at least 50 mm without permitting contact with any underlying rigid material.

(b) It shall be constructed with energy-absorbing material that deflects or collapses to within 32 mm of a rigid test panel surface without permitting contact with any rigid material. Any rigid material between 13 and 32 mm from the panel surface shall have a minimum vertical height of not less than 25 mm.

(c) Along not less than 50 continuous mm of its length, the armrest shall, when measured vertically in side elevation, provide at least 50 mm of coverage within the pelvic impact area.

**S5.5.2 Folding armrests.** Each armrest that folds into the seat back or between two seat backs shall either:

(a) Meet the requirements of S5.5.1; or

(b) Be constructed of or covered with energy-absorbing material.

**S6 Requirements for upper interior components.**

**S6.1 Vehicles manufactured on or after September 1, 1998.** Except as provided in S6.3 and S6.1.4, for vehicles manufactured on or after September 1, 1998 and before September 1, 2002, a percentage of the manufacturer's production, as specified in S6.1.1, S6.1.2, or S6.1.3 shall conform, at the manufacturer's option, to either S6.1(a) or S6.1(b). For vehicles manufactured by final stage manufacturers on or after September 1, 1998 and before September 1, 2006, a percentage of the manufacturer's production as specified in S6.1.4 shall, except as provided in S6.3, conform, to either S6.1(a) or S6.1(b). The manufacturer shall select the option by the time it certifies the vehicle and may not thereafter select a different option for the vehicle.

(a) When tested under the conditions of S8, comply with the requirements specified in S7 at the target locations specified in S10 when impacted by the free motion headform specified in S8.9 at any speed up to and including 24 km/h (15 mph). The requirements do not apply to any target that cannot be located using the procedures of S10.

(b) When equipped with a dynamically deployed upper interior head protection system and tested under the conditions of S8, comply with the requirements specified in S7 at the target locations specified in S10 as follows:

(1) Targets that are not located over any point inside the area measured

along the contour of the vehicle surface within 50 mm (2.0 inch) of the periphery of the stowed system projected perpendicularly onto the vehicle interior surface, including mounting and inflation components but exclusive of any cover or covers, shall be impacted by the free motion headform specified in S8.9 at any speed up to and including 24 km/h (15 mph). The requirements do not apply to any targets that can not be located by using the procedures of S10.

(2) Targets that are over any point inside the area measured along the contour of the vehicle interior within 50 mm (2.0 inch) of the periphery of the stowed system projected perpendicularly onto the vehicle interior surface, including mounting and inflation components but exclusive of any cover or covers, when the dynamically deployed upper interior head protection system is not deployed, shall be impacted by the free motion headform specified in S8.9 at any speed up to and including 19 km/h (12 mph) with the system undeployed. The requirements do not apply to any target that can not be located using the procedures of S10.

(3) Each vehicle shall, when equipped with a dummy test device specified in Part 572, Subpart M, and tested as specified in S8.16 through S8.28, comply with the requirements specified in S7 when crashed into a fixed, rigid pole of 254 mm in diameter, at any velocity between 24 kilometers per hour (15 mph) and 29 kilometers per hour (18 mph).

**S6.1.1 Phase-in Schedule #1**

**S6.1.1.1 Vehicles manufactured on or after September 1, 1998 and before September 1, 1999.** Subject to S6.1.5(a), for vehicles manufactured by a manufacturer on or after September 1, 1998 and before September 1, 1999, the amount of vehicles complying with S7 shall be not less than 10 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 1996 and before September 1, 1999, or

(b) The manufacturer's production on or after September 1, 1998 and before September 1, 1999.

**S6.1.1.2 Vehicles manufactured on or after September 1, 1999 and before September 1, 2000.** Subject to S6.1.5(b), for vehicles manufactured by a manufacturer on or after September 1, 1999 and before September 1, 2000, the amount of vehicles complying with S7 shall be not less than 25 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 1997 and before September 1, 2000, or

(b) The manufacturer's production on or after September 1, 1999 and before September 1, 2000.

**S6.1.1.3 Vehicles manufactured on or after September 1, 2000 and before September 1, 2001.** Subject to S6.1.5(c), for vehicles manufactured by a manufacturer on or after September 1, 2000 and before September 1, 2001, the amount of vehicles complying with S7 shall be not less than 40 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 1998 and before September 1, 2001, or

(b) The manufacturer's production on or after September 1, 2000 and before September 1, 2001.

**S6.1.1.4 Vehicles manufactured on or after September 1, 2001 and before September 1, 2002.** Subject to S6.1.5(d), for vehicles manufactured by a manufacturer on or after September 1, 2001 and before September 1, 2002, the amount of vehicles complying with S7 shall be not less than 70 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 1999 and before September 1, 2002, or

(b) The manufacturer's production on or after September 1, 2001 and before September 1, 2002.

**S6.1.2 Phase-in Schedule #2**

**S6.1.2.1 Vehicles manufactured on or after September 1, 1998 and before September 1, 1999.** Subject to S6.1.5(a), for vehicles manufactured by a manufacturer on or after September 1, 1998 and before September 1, 1999, the amount of vehicles complying with S7 shall be not less than seven percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 1996 and before September 1, 1999, or

(b) The manufacturer's production on or after September 1, 1998 and before September 1, 1999.

**S6.1.2.2 Vehicles manufactured on or after September 1, 1999 and before September 1, 2000.** Subject to S6.1.5(b), for vehicles manufactured by a manufacturer on or after September 1, 1999 and before September 1, 2000, the amount of vehicles complying with S7 shall be not less than 25 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 1997 and before September 1, 2000, or

(b) The manufacturer's production on or after September 1, 1999 and before September 1, 2000.

**S6.1.2.2 Vehicles manufactured on or after September 1, 1999 and before September 1, 2000.** Subject to S6.1.5(b), for vehicles manufactured by a manufacturer on or after September 1, 1999 and before September 1, 2000, the amount of vehicles complying with S7 shall be not less than 81 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 1997 and before September 1, 2000, or

(b) The manufacturer's production on or after September 1, 1999 and before September 1, 2000.

**S6.1.2.3 Vehicles manufactured on or after September 1, 2000 and before September 1, 2001.** Subject to S6.1.5(c), for vehicles manufactured by a manufacturer on or after September 1, 2000 and before September 1, 2001, the amount of vehicles complying with S7 shall be not less than 40 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 1998 and before September 1, 2001, or

(b) The manufacturer's production on or after September 1, 2000 and before September 1, 2001.

**S6.1.2.4 Vehicles manufactured on or after September 1, 2001 and before September 1, 2002.** Subject to S6.1.5(d), for vehicles manufactured by a manufacturer on or after September 1, 2001 and before September 1, 2002, the amount of vehicles complying with S7 shall be not less than 70 percent of:

(a) The manufacturer's average annual production of vehicles manufactured on or after September 1, 1999 and before September 1, 2002, or

(b) The manufacturer's production on or after September 1, 2001 and before September 1, 2002.

**S6.1.3 Phase-in Schedule #3**

**S6.1.3.1 Vehicles manufactured on or after September 1, 1998 and before September 1, 1999** are not required to comply with the requirements specified in S7.

**S6.1.3.2 Vehicles manufactured on or after September 1, 1999** shall comply with the requirements specified in S7.

**S6.1.4 Phase-in Schedule #4** A final stage manufacturer or alterer may, at its option, comply with the requirements set forth in S6.1.4.1 and S6.1.4.2.

**S6.1.4.1 Vehicles manufactured on or after September 1, 1998 and before September 1, 2006** are not required to comply with the requirements specified in S7.

**S6.1.4.2 Vehicles manufactured on or after September 1, 2006** shall comply with the requirements specified in S7.

**S6.1.5 Calculation of complying vehicles.**

(a) For the purposes of complying with S6.1.1.1 or S6.1.2.1, a manufacturer may count a vehicle if it is manufactured on or after May 8, 1997, but before September 1, 1999.

(b) For the purposes of complying with S6.1.1.2 or S6.1.2.2, a manufacturer may count a vehicle if it:

(1) Is manufactured on or after May 8, 1997, but before September 1, 2000, and

(2) Is not counted toward compliance with S6.1.1.1 or S6.1.2.1, as appropriate.

(c) For the purposes of complying with S6.1.1.3 or S6.1.2.3, a manufacturer may count a vehicle if it:

(1) Is manufactured on or after May 8, 1997, but before September 1, 2001, and

(2) Is not counted toward compliance with S6.1.1.1, S6.1.1.2, S6.1.2.1, or S6.1.2.2, as appropriate.

(d) For the purposes of complying with S6.1.1.4 or S6.1.2.4, a manufacturer may count a vehicle if it:

(1) Is manufactured on or after May 8, 1997, but before September 1, 2002, and

(2) Is not counted toward compliance with S6.1.1.1, S6.1.1.2, S6.1.1.3, S6.1.2.1, S6.1.2.2, or S6.1.2.3, as appropriate.

**S6.1.6 Vehicles produced by more than one manufacturer.**

**S6.1.6.1** For the purpose of calculating average annual production of vehicles for each manufacturer and the number of vehicles manufactured by each manufacturer under S6.1.1 through S6.1.4, a vehicle produced by more than one manufacturer shall be attributed to a single manufacturer as follows, subject to S6.1.6.2.

(a) A vehicle which is imported shall be attributed to the importer.

(b) A vehicle manufactured in the United States by more than one manufacturer, one of which also markets the vehicle, shall be attributed to the manufacturer which markets the vehicle.

S6.1.6.2 A vehicle produced by more than one manufacturer must be attributed to any one of the vehicle's manufacturers specified by an express written contract, reported to the National Highway Traffic Safety Administration under 49 CFR Part 585, between the manufacturer so specified and the manufacturer to which the vehicle would otherwise be attributed under S6.1.6.1.

S6.2 *Vehicles manufactured on or after September 1, 2002 and vehicles built in two or more stages manufactured after September 1, 2006.* Except as provided in S6.1.4 and S6.3, vehicles manufactured on or after September 1, 2002 shall, when tested under the conditions of S8, conform, at the manufacturer's option, to either S6.2(a) or S6.2(b). Vehicles manufactured by final stage manufacturers on or after September 1, 2006 shall, except as provided in S6.3, when tested under the conditions of S8, conform, at the manufacturer's option, to either S6.2(a) or S6.2(b). The manufacturer shall select the option by the time it certifies the vehicle and may not thereafter select a different option for the vehicle.

(a) When tested under the conditions of S8, comply with the requirements specified in S7 at the target locations specified in S10 when impacted by the free motion headform specified in S8.9 at any speed up to and including 24 km/h (15 mph). The requirements do not apply to any target that cannot be located using the procedures of S10.

(b) When equipped with a dynamically deployed upper interior head protection system and tested under the conditions of S8, comply with the requirements specified in S7 at the target locations specified in S10 as follows:

(1) Targets that are not located over any point inside the area measured along the contour of the vehicle surface within 50 mm (2.0 inch) of the periphery of the stowed system projected perpendicularly onto the vehicle interior surface, including mounting and inflation components but exclusive of any cover or covers, shall be impacted by the free motion headform specified in S8.9 at any speed up to and including 24 km/h (15 mph). The requirements do not apply to any targets that cannot be located by using the procedures of S10.

(2) Targets that are over any point inside the area measured along the contour of the vehicle interior within 50 mm (2.0 inch) of the periphery of the stowed system projected perpendicularly onto the vehicle interior surface, including mounting and inflation components but exclusive of any cover or covers, when the dynamically deployed upper interior head protection system is not deployed, shall be impacted by the free motion headform specified in S8.9 at any speed up to and including 19 km/h (12 mph) with the system undeployed. The requirements do not apply to any target that cannot be located using the procedures of S10.

(3) Each vehicle shall, when equipped with a dummy test device specified in Part 572, Subpart M, and tested as specified in S8.16 through S8.28, comply with the requirements specified in S7 when crashed into a fixed, rigid pole of 254 mm in diameter, at any velocity between 24 kilometers per hour (15 mph) and 29 kilometers per hour (18 mph).

S6.3 A vehicle need not meet the requirements of S6.1 through S6.2 for:

(a) Any target located on a convertible roof frame or a convertible roof linkage mechanism.

(b) Any target located rearward of a vertical plane 600 mm behind the seating reference point of the rearmost designated seating position.

(c) Any target located rearward of a vertical plane 600 mm behind the seating reference point of the driver's seating position in an ambulance or a motor home.

(d) Any target in a walk-in van-type vehicles.

(e) Any target located on the seat belt mounting structures, door frames and other door frames before December 1, 2005.

S7 *Performance Criterion.* The HIC(d) shall not exceed 1000 when calculated in accordance with the following formula:

$$HIC = \left[ \frac{1}{(t_2 - t_1)} \int_{t_1}^{t_2} a dt \right]^{2.5} (t_2 - t_1)$$

Where the term  $a$  is the resultant head acceleration expressed as a multiple of  $g$  (the acceleration of gravity), and  $t_1$

and t2 are any two points in time during the impact which are separated by not more than a 36 millisecond time interval.

(a) For the free motion headform;  $HIC(d)=0.75446$  (free motion headform  $HIC$ )+166.4.

(b) For the part 572, subpart M, anthropomorphic test dummy;  $HIC(d)=HIC$ .

**S8 Target location and test conditions.** The vehicle shall be tested and the targets specified in S10 located under the following conditions.

**S8.1 Vehicle test attitude.**

(a) The vehicle is supported off its suspension at an attitude determined in accordance with S8.1(b).

(b) Directly above each wheel opening, determine the vertical distance between a level surface and a standard reference point on the test vehicle's body under the conditions of S8.1(b)(1) through S8.1(b)(3).

(1) The vehicle is loaded to its unloaded vehicle weight, plus its rated cargo and luggage capacity or 136 kg, whichever is less, secured in the luggage area. The load placed in the cargo area is centered over the longitudinal centerline of the vehicle.

(2) The vehicle is filled to 100 percent of all fluid capacities.

(3) All tires are inflated to the manufacturer's specifications listed on the vehicle's tire placard.

**S8.2 Windows and Sunroofs.**

(a) Movable vehicle windows are placed in the fully open position.

(b) For testing, any window on the opposite side of the longitudinal centerline of the vehicle from the target to be impacted may be removed.

(c) For testing, movable sunroofs are placed in the fully open position.

**S8.3 Convertible tops.** The top, if any, of convertibles and open-body type vehicles is in the closed passenger compartment configuration.

**S8.4 Doors.**

(a) Except as provided in S8.4(b) or S8.4(c), doors, including any rear hatchback or tailgate, are fully closed and latched but not locked.

(b) During testing, any side door on the opposite side of the longitudinal centerline of the vehicle from the target to be impacted may be open or removed.

(c) During testing, any rear hatchback or tailgate may be open or removed for testing any target except targets on the rear header, rearmost pillars, or the rearmost other side rail on either side of the vehicle.

**S8.5 Sun visors.** Each sun visor shall be placed in any position where one side of the visor is in contact with the vehicle interior surface (windshield, side rail, front header, roof, etc.).

**S8.6 Steering wheel and seats.**

(a) During targetting, the steering wheel and seats may be placed in any position intended for use while the vehicle is in motion.

(b) During testing, the steering wheel and seats may be removed from the vehicle.

**S8.7 Seat belt anchorages.** If a target is on a seat belt anchorage, and if the seat belt anchorage is adjustable, tests are conducted with the anchorage adjusted to a point midway between the two extreme adjustment positions. If the anchorage has distinct adjustment positions, none of which is midway between the two extreme positions, tests are conducted with the anchorage adjusted to the nearest position above the midpoint of the two extreme positions.

**S8.8 Temperature and humidity.**

(a) The ambient temperature is between 19 degrees C. and 26 degrees C., at any relative humidity between 10 percent and 70 percent.

(b) Tests are not conducted unless the headform specified in S8.9 is exposed to the conditions specified in S8.8(a) for a period not less than four hours.

**S8.9 Headform.** The headform used for testing conforms to the specifications of part 572, subpart L of this chapter.

**S8.10 Forehead impact zone.** The forehead impact zone of the headform is determined according to the procedure specified in (a) through (f).

(a) Position the headform so that the baseplate of the skull is horizontal. The midsagittal plane of the headform is designated as Plane S.

(b) From the center of the threaded hole on top of the headform, draw a 69 mm line forward toward the forehead, coincident with Plane S, along the contour of the outer skin of the headform.

The front end of the line is designated as Point E. From Point P, draw a 100 mm line forward toward the forehead, coincident with Plane S, along the contour of the outer skin of the headform. The front end of the line is designated as Point O.

(c) Draw a 125 mm line which is coincident with a horizontal plane along the contour of the outer skin of the forehead from left to right through Point O so that the line is bisected at Point O. The end of the line on the left side of the headform is designated as Point a and the end on the right as Point b.

(d) Draw another 125 mm line which is coincident with a vertical plane along the contour of the outer skin of the forehead through Point P so that the line is bisected at Point P. The end of the line on the left side of the headform is designated as Point c and the end on the right as Point d.

(e) Draw a line from Point a to Point c along the contour of the outer skin of the headform using a flexible steel tape. Using the same method, draw a line from Point b to Point d.

(f) The forehead impact zone is the surface area on the FMH forehead bounded by lines a-O-b and c-P-d, and a-c and b-d.

S8.11 *Target circle.* The area of the vehicle to be impacted by the headform is marked with a solid circle 12.7 mm in diameter, centered on the targets specified in S10, using any transferable opaque coloring medium.

S8.12 *Location of head center of gravity.*

(a) *Location of head center of gravity for front outboard designated seating positions (CG-F).* For determination of head center of gravity, all directions are in reference to the seat orientation.

(1) *Location of rearmost CG-F (CG-F2).* For front outboard designated seating positions, the head center of gravity with the seat in its rearmost normal

design driving or riding position (CG-F2) is located 160 mm rearward and 660 mm upward from the seating reference point.

(2) *Location of forwardmost CG-F (CG-F1).* For front outboard designated seating positions, the head center of gravity with the seat in its forwardmost adjustment position (CG-F1) is located horizontally forward of CG-F2 by the distance equal to the fore-aft distance of the seat track.

(b) *Location of head center of gravity for rear outboard designated seating positions (CG-R).* For rear outboard designated seating positions, the head center of gravity (CG-R) is located 160 mm rearward, relative to the seat orientation, and 660 mm upward from the seating reference point.

S8.13 *Impact configuration.*

S8.13.1 The headform is launched from any location inside the vehicle which meets the conditions of S8.13.4. At the time of launch, the midsagittal plane of the headform is vertical and the headform is upright.

S8.13.2 The headform travels freely through the air, along a velocity vector that is perpendicular to the headform's skull cap plate, not less than 25 mm before making any contact with the vehicle.

S8.13.3 At the time of initial contact between the headform and the vehicle interior surface, some portion of the forehead impact zone of the headform must contact some portion of the target circle.

S8.13.4 *Approach angles.* The headform launching angle is as specified in Table 1. For components for which Table 1 specifies a range of angles, the headform launching angle is within the limits determined using the procedures specified in S8.13.4.1 and S8.13.4.2, and within the range specified in Table 1, using the orthogonal reference system specified in S9.

TABLE 1—APPROACH ANGLE LIMITS (IN DEGREES)

Target component	Horizontal Angle	Vertical angle
Front Header .....	180 .....	0-50
Rear Header .....	0 or 360 .....	0-50
Left Side Rail .....	270 .....	0-50
Right Side Rail .....	90 .....	0-50
Left Sliding Door Track .....	270 .....	0-50
Right Sliding Door Track .....	90 .....	0-50
Left A-Pillar .....	195-255 .....	-5-50



TABLE 1—APPROACH ANGLE LIMITS (IN DEGREES)—Continued

Target component	Horizontal Angle	Vertical angle
Right A-Pillar .....	105-165 .....	-5-50
Left B-Pillar .....	195-345 .....	-10-50
Right B-Pillar .....	15-165 .....	-10-50
Left Door Frame .....	195-345 .....	-10-50
Right Door Frame .....	15-165 .....	-10-50
Other Left Pillars .....	270 .....	-10-50
Other Right Pillars .....	90 .....	-10-50
Other Left Door Frame .....	270 .....	-10-50
Other Right Door Frame .....	90 .....	-10-50
Left Rearmost Pillar .....	270-345 .....	-10-50
Right Rearmost Pillar .....	15-90 .....	-10-50
Upper Roof .....	Any .....	0-50
Overhead Rollbar .....	0 or 180 .....	0-50
Brace or Stiffener .....	90 or 270 .....	0-50
Left Seat Belt Mounting Structure .....	195-345 .....	-10-50
Right Seat Belt Mounting Structure .....	15-165 .....	-10-50
Seat Belt Anchorages .....	Any .....	0-50

**S8.13.4.1 Horizontal Approach Angles for Headform Impacts.**

**(a) Left A-Pillar Horizontal Approach Angles.**

(1) Locate a line formed by the shortest horizontal distance between CG-F1 for the left seat and the right A-pillar. The maximum horizontal approach angle for the left A-pillar equals 360 degrees minus the angle formed by that line and the X-axis of the vehicle, measured counterclockwise.

(2) Locate a line formed by the shortest horizontal distance between CG-F2 for the left seat and the left A-pillar. The minimum horizontal approach angle for the left A-pillar impact equals the angle formed by that line and the X-axis of the vehicle, measured counterclockwise.

**(b) Right A-Pillar Horizontal Approach Angles.**

(1) Locate a line formed by the shortest horizontal distance between CG-F1 for the right seat and the left A-pillar. The minimum horizontal approach angle for the right A-pillar equals 360 degrees minus the angle formed by that line and the X-axis of the vehicle, measured counterclockwise.

(2) Locate a line formed by the shortest horizontal distance between CG-F2 for the right seat and the right A-pillar. The maximum horizontal approach angle for the right A-pillar impact equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise.

**(c) Left B-Pillar Horizontal Approach Angles.**

(1) Locate a line formed by the shortest horizontal distance between CG-F2 for the left seat and the left B-pillar. The maximum horizontal approach angle for the left B-pillar equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise, or 270 degrees, whichever is greater.

(2) Locate a line formed by the shortest horizontal distance between CG-R for the left seat and the left B-pillar. The minimum horizontal approach angle for the left B-pillar equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise.

**(d) Right B-Pillar Horizontal Approach Angles.**

(1) Locate a line formed by the shortest horizontal distance between CG-F2 for the right seat and the right B-pillar. The minimum horizontal approach angle for the right B-pillar equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise, or 90 degrees, whichever is less.

(2) Locate a line formed by the shortest horizontal distance between CG-R for the right seat and the right B-pillar. The maximum horizontal approach angle for the right B-pillar equals the angle between that line and the X-axis of the vehicle measured counterclockwise.

**(e) Left door frame horizontal approach angles.**

(1) Locate a line formed by the shortest horizontal distance between CG-F2

for the left seat and the left door frame. The maximum horizontal approach angle for the left door frame equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise, or 270 degrees, whichever is greater.

(2) Locate a line formed by the shortest horizontal distance between CG-R for the left seat and the left door frame. The minimum horizontal approach angle for the left door frame equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise.

(f) *Right door frame horizontal approach angles.*

(1) Locate a line formed by the shortest horizontal distance between CG-F2 for the right seat and the right door frame. The minimum horizontal approach angle for the right door frame equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise, or 90 degrees, whichever is less.

(2) Locate a line formed by the shortest horizontal distance between CG-R for the right seat and the right door frame. The maximum horizontal approach angle for the right door frame equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise.

(g) *Left seat belt mounting structure horizontal approach angles.*

(1) Locate a line formed by the shortest horizontal distance between CG-F2 for the left seat and the left seat belt mounting structure. If the seat belt mounting structure is below a horizontal plane passing through CG-F2 for the left seat, locate the point 200 mm directly below CG-F2 and locate a line formed by the shortest horizontal distance between that point and the left seat belt mounting structure. The maximum horizontal approach angle for the left seat belt mounting structure equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise, or 270 degrees, whichever is greater.

(2) Locate a line formed by the shortest horizontal distance between CG-R for the left seat and the left seat belt mounting structure. If the seat belt mounting structure is below a horizontal plane passing through CG-R for

the left seat, locate the point 200 mm directly below CG-R and locate a line formed by the shortest horizontal distance between that point and the left seat belt mounting structure. The minimum horizontal approach angle for the left seat belt mounting structure equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise. If the CG-R does not exist, or is forward of the seat belt mounting structure, the maximum horizontal approach angle is 270 degrees.

(h) *Right seat belt mounting structure horizontal approach angles.*

(1) Locate a line formed by the shortest horizontal distance between CG-F2 for the right seat and the right seat belt mounting structure. If the seat belt mounting structure is below a horizontal plane passing through CG-F2 for the right seat, locate the point 200 mm directly below that CG-F2 and locate a line formed by the shortest horizontal distance between that point and the right seat belt mounting structure. The minimum horizontal approach angle for the right seat belt mounting structure equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise, or 90 degrees, whichever is less.

(2) Locate a line formed by the shortest horizontal distance between CG-R for the right seat and the right seat belt mounting structure. If the seat belt mounting structure is below a horizontal plane passing through CG-R, locate the point 200 mm directly below CG-R and locate a line formed by the shortest horizontal distance between that point and the right seat belt mounting structure. The maximum horizontal approach angle for the right seat belt mounting structure equals the angle formed by that line and the X-axis of the vehicle measured counterclockwise. If the CG-R does not exist, or is forward of the seat belt mounting structure, the maximum horizontal approach angle is 90 degrees.

#### S8.13.4.2 Vertical Approach Angles

(a) Position the forehead impact zone in contact with the selected target at the prescribed horizontal approach angle. If a range of horizontal approach angles is prescribed, position the forehead impact zone in contact with the

selected target at any horizontal approach angle within the range which may be used for testing.

(b) Keeping the forehead impact zone in contact with the target, rotate the FMH upward until the lip, chin or other part of the FMH contacts the component or other portion of the vehicle interior.

(1) Except as provided in S8.13.4.2(b)(2), keeping the forehead impact zone in contact with the target, rotate the FMH downward by 5 degrees for each target to determine the maximum vertical angle.

(2) For all pillars, except A-pillars, and all door frames and seat belt mounting structures, keeping the forehead impact zone in contact with the target, rotate the FMH downward by 10 degrees for each target to determine the maximum vertical angle.

#### S8.14 *Multiple impacts.*

(a) A vehicle being tested may be impacted multiple times, subject to the limitations in S8.14(b), (c), (d) and (e).

(b) As measured as provided in S8.14(d), impacts within 300 mm of each other may not occur less than 30 minutes apart.

(c) As measured as provided in S8.14(d), no impact may occur within 150 mm of any other impact.

(d) For S8.14(b) and S8.14(c), the distance between impacts is the distance between the center of the target circle specified in S8.11 for each impact, measured along the vehicle interior.

(e) No impact may occur within the "exclusion zone" of any pillar target specified in S10.1 through S10.4, door frame target specified in S10.14 and S10.15, upper roof target specified in S10.9, or seat belt mounting structure target specified in S10.16. The "exclusion zone" is determined according to the procedure in S8.14(f) through S8.14(k).

(f) Locate the point, Point X, at the center of the target circle specified in S8.11 for the tested target.

(g) Determine two spheres centered on Point X. Radii of these spheres are 150 mm and 200 mm, respectively.

(h) Locate a horizontal plane passing through Point X. Determine the intersection points, if they exist, of the small sphere surface, the horizontal plane, and the vehicle interior surface.

Relative to Point X, the point on the left is Point L and the point on the right is Point R.

(i) Locate a vertical plane, Plane Z, passing through Point X and coincident (within  $\pm 5^\circ$ ) with the horizontal approach angle used or intended for use in testing the target centered on Point X.

(j) If either Point L or Point R does not exist, extend Line LX and/or Line RX, as appropriate, perpendicular to Plane Z beyond Point X by 150 mm. The end of the line is designated as Point L or Point R, as appropriate.

(k) Locate a vertical plane, Plane ZL, passing through Point L and parallel to Plane Z. Locate another vertical plane, Plane ZR, passing through Point R and parallel to Plane Z. The "exclusion zone" is the vehicle interior surface area between Plane ZL and Plane ZR below the upper boundary of the smaller sphere and above the lower boundary of the larger sphere. Points on the intersection of the vehicle interior surface and the large sphere below the target, the small sphere above the target, Plane ZL and Plane ZR are not included in the "exclusion zone."

S8.15 *Upper Roof.* The upper roof of a vehicle is determined according to the procedure specified in S8.15 (a) through (h).

(a) Locate the transverse vertical plane A at the forwardmost point where it contacts the interior roof (including trim) at the vehicle centerline.

(b) Locate the transverse vertical plane B at the rearmost point where it contacts the interior roof (including trim) at the vehicle centerline.

(c) Measure the horizontal distance (D1) between Plane A and Plane B.

(d) Locate the vertical longitudinal plane C at the leftmost point at which a vertical transverse plane, located 300 mm rearward of the A-pillar reference point described in S10.1(a), contacts the interior roof (including trim).

(e) Locate the vertical longitudinal plane D at the rightmost point at which a vertical transverse plane, located 300 mm rearward of the A-pillar reference point described in S10.1(a), contacts the interior roof (including trim).

(f) Measure the horizontal distance (D2) between Plane C and Plane D.

(g) Locate a point (Point M) on the interior roof surface, midway between Plane A and Plane B along the vehicle longitudinal centerline.

(h) The upper roof zone is the area of the vehicle upper interior surface bounded by the four planes described in S8.15(h)(1) and S8.15(h)(2):

(1) A transverse vertical plane E located at a distance of (.35 D1) forward of Point M and a transverse vertical plane F located at a distance of (.35 D1) rearward of Point M, measured horizontally.

(2) A longitudinal vertical plane G located at a distance of (.35 D2) to the left of Point M and a longitudinal vertical plane H located at a distance of (.35 D2) to the right of Point M, measured horizontally.

S8.16 *Test weight—vehicle to pole test.* Each vehicle shall be loaded to its unloaded vehicle weight, plus 136 kilograms (300 pounds) or its rated cargo and luggage capacity (whichever is less), secured in the luggage or load-carrying area, plus the weight of the necessary anthropomorphic test dummy. Any added test equipment shall be located away from impact areas in secure places in the vehicle.

S8.17 *Vehicle test attitude—vehicle to pole test.* Determine the distance between a level surface and a standard reference point on the test vehicle's body, directly above each wheel opening, when the vehicle is in its "as delivered" condition. The "as delivered" condition is the vehicle as received at the test site, filled to 100 percent of all fluid capacities and with all tires inflated to the manufacturer's specifications listed on the vehicle's tire placard. Determine the distance between the same level surface and the same standard reference points in the vehicle's "fully loaded condition." The "fully loaded condition" is the test vehicle loaded in accordance with S8.16. The load placed in the cargo area shall be centered over the longitudinal centerline of the vehicle. The pretest vehicle attitude shall be the same as either the "as delivered" or "fully loaded" attitude or is between the "as delivered" attitude and the "fully loaded" attitude. If the test configuration requires that the vehicle be elevated off the

ground, the pretest vehicle attitude must be maintained.

S8.18 *Adjustable seats—vehicle to pole test.* Initially, adjustable seats shall be adjusted as specified in S6.3 of Standard 214 (49 CFR 571.214).

S8.19 *Adjustable seat back placement—vehicle to pole test.* Initially, position adjustable seat backs in the manner specified in S6.4 of Standard 214 (49 CFR 571.214).

S8.20 *Adjustable steering wheels—vehicle to pole test.* Adjustable steering controls shall be adjusted so that the steering wheel hub is at the geometric center of the locus it describes when it is moved through its full range of driving positions.

S8.21 *Windows and sunroof—vehicle to pole test.* Movable windows and vents shall be placed in the fully open position. Any sunroof shall be placed in the fully closed position.

S8.22 *Convertible tops—vehicle to pole test.* The top, if any, of convertibles and open-body type vehicles shall be in the closed passenger compartment configuration.

S8.23 *Doors—vehicle to pole test.* Doors, including any rear hatchback or tailgate, shall be fully closed and latched but not locked.

S8.24 *Impact reference line—vehicle to pole test.* On the striking side of the vehicle, place an impact reference line at the intersection of the vehicle exterior and a transverse vertical plane passing through the center of gravity of the head of the dummy seated in accordance with S8.28, in the front outboard designated seating position.

S8.25 *Rigid Pole—vehicle to pole test.* The rigid pole is a vertical metal structure beginning no more than 102 millimeters (4 inches) above the lowest point of the tires on the striking side of the test vehicle when the vehicle is loaded as specified in S8.16 and extending above the highest point of the roof of the test vehicle. The pole is 254 mm  $\pm$  3 mm (10 inches) in diameter and set off from any mounting surface, such as a barrier or other structure, so that the test vehicle will not contact such a mount or support at any time within 100 milliseconds of the initiation of vehicle to pole contact.

**S8.26 Impact configuration—vehicle to pole test.** The rigid pole shall be stationary. The test vehicle shall be propelled sideways so that its line of forward motion forms an angle of 90 degrees ( $\pm 3$  degrees) with the vehicle's longitudinal center line. The impact reference line shall be aligned with the center line of the rigid pole so that, when the vehicle-to-pole contact occurs, the center line of the pole contacts the vehicle area bounded by two transverse vertical planes 38 mm (1.5 inches) forward and aft of the impact reference line.

**S8.27 Anthropomorphic test dummy—vehicle to pole test.**

**S8.27.1** The anthropomorphic test dummy used for evaluation of a vehicle's head impact protection shall conform to the requirements of subpart M of part 572 of this chapter (49 CFR part 572, subpart M). In a test in which the test vehicle is striking its left side, the dummy is to be configured and instrumented to strike on its left side, in accordance with subpart M of part 572. In a test in which the test vehicle is striking its right side, the dummy is to be configured and instrumented to strike its right side, in accordance with subpart M of part 572.

**S8.27.2** The part 572, subpart M, test dummy specified is clothed in form fitting cotton stretch garments with short sleeves and midcalf length pants. Each foot of the test dummy is equipped with a size 11EEE shoe, which meets the configuration size, sole, and heel thickness specifications of MIL-S-13192 (1976) and weighs  $0.57 \pm 0.09$  kilograms ( $1.25 \pm 0.2$  pounds).

**S8.27.3** Limb joints shall be set at between 1 and 2 g's. Leg joints are adjusted with the torso in the supine position.

**S8.27.4** The stabilized temperature of the test dummy at the time of the side impact test shall be at any temperature between 20.6 degrees C. and 22.2 degrees C.

**S8.27.5** The acceleration data from the accelerometers installed inside the skull cavity of the test dummy are processed according to the practices set forth in SAE Recommended Practice J211, March 1995, "Instrumentation for Impact Tests," Class 1000.

**S8.28 Positioning procedure for the Part 572 Subpart M Test Dummy—vehicle to pole test.** The part 572, subpart M, test dummy shall be initially positioned in the front outboard seating position on the struck side of the vehicle in accordance with the provisions of S7 of Standard 214, 49 CFR 571.214, and the vehicle seat shall be positioned as specified in S6.3 and S6.4 of that standard. The position of the dummy shall then be measured as follows. Locate the horizontal plane passing through the dummy head center of gravity. Identify the rearmost point on the dummy head in that plane. Construct a line in the plane that contains the rearward point of the front door daylight opening and is perpendicular to the longitudinal vehicle centerline. Measure the longitudinal distance between the rearmost point on the dummy head and this line. If this distance is less than 50 mm (2 inches) or the point is not forward of the line, then the seat and/or dummy positions shall be adjusted as follows. First, the seat back angle is adjusted, a maximum of 5 degrees, until a 50 mm (2 inches) distance is achieved. If this is not sufficient to produce the 50 mm (2 inches) distance, the seat is moved forward until the 50 mm (2 inches) distance is achieved or until the knees of the dummy contact the dashboard or knee bolster, whichever comes first. If the required distance cannot be achieved through movement of the seat, the seat back angle shall be adjusted even further forward until the 50 mm (2 inches) distance is obtained or until the seat back is in its full upright locking position.

**S9. Orthogonal Reference System.** The approach angles specified in S8.13.4 are determined using the reference system specified in S9.1 through S9.4.

**S9.1** An orthogonal reference system consisting of a longitudinal X axis and a transverse Y axis in the same horizontal plane and a vertical Z axis through the intersection of X and Y is used to define the horizontal direction of approach of the headform. The X-Z plane is the vertical longitudinal zero plane and is parallel to the longitudinal centerline of the vehicle. The X-Y plane is the horizontal zero plane parallel to the ground. The Y-Z plane is

the vertical transverse zero plane that is perpendicular to the X-Y and X-Z planes. The X coordinate is negative forward of the Y-Z plane and positive to the rear. The Y coordinate is negative to the left of the X-Z plane and positive to the right. The Z coordinate is negative below the X-Y plane and positive above it. (See Figure 1.)

S9.2 The origin of the reference system is the center of gravity of the headform at the time immediately prior to launch for each test.

S9.3 The horizontal approach angle is the angle between the X axis and the headform impact velocity vector projected onto the horizontal zero plane, measured in the horizontal zero plane in the counter-clockwise direction. A 0 degree horizontal vector and a 360 degree horizontal vector point in the positive X direction; a 90 degree horizontal vector points in the positive Y direction; a 180 degree horizontal vector points in the negative X direction; and a 270 degree horizontal vector points in the negative Y direction. (See Figure 2.)

S9.4 The vertical approach angle is the angle between the horizontal plane and the velocity vector, measured in the midsagittal plane of the headform. A 0 degree vertical vector in Table I coincides with the horizontal plane and a vertical vector of greater than 0 degrees in Table I makes an upward angle of the same number of degrees with that plane.

#### S10 Target Locations.

(a) The target locations specified in S10.1 through S10.16 are located on both sides of the vehicle and, except as specified in S10(b), are determined using the procedures specified in those paragraphs.

(b) Except as specified in S10(c), if there is no combination of horizontal and vertical angles specified in S8.13.4 at which the forehead impact zone of the free motion headform can contact one of the targets located using the procedures in S10.1 through S10.16, the center of that target is moved to any location within a sphere with a radius of 25 mm, centered on the center of the original target, which the forehead impact zone can contact at one or more combination of angles.

(c) If there is no point within the sphere specified in S10(b) which the forehead impact zone of the free motion headform can contact at one or more combination of horizontal and vertical angles specified in S8.13.4, the radius of the sphere is increased by 25 mm increments until the sphere contains at least one point that can be contacted at one or more combination of angles.

#### S10.1 A-pillar targets

(a) *A-pillar reference point and target AP1.* On the vehicle exterior, locate a transverse vertical plane (Plane 1) which contacts the rearmost point of the windshield trim. The intersection of Plane 1 and the vehicle exterior surface is Line 1. Measuring along the vehicle exterior surface, locate a point (Point 1) on Line 1 that is 125 mm inboard of the intersection of Line 1 and a vertical plane tangent to the vehicle at the outboardmost point on Line 1 with the vehicle side door open. Measuring along the vehicle exterior surface in a longitudinal vertical plane (Plane 2) passing through Point 1, locate a point (Point 2) 50 mm rearward of Point 1. Locate the A-pillar reference point (Point APR) at the intersection of the interior roof surface and a line that is perpendicular to the vehicle exterior surface at Point 2. Target AP1 is located at point APR.

(b) *Target AP2.* Locate the horizontal plane (Plane 3) which intersects point APR. Locate the horizontal plane (Plane 4) which is 88 mm below Plane 3. Target AP2 is the point in Plane 4 and on the A-pillar which is closest to CG-F2 for the nearest seating position.

(c) *Target AP3.* Locate the horizontal plane (Plane 5) containing the highest point at the intersection of the dashboard and the A-pillar. Locate a horizontal plane (Plane 6) half-way between Plane 3 and Plane 5. Target AP3 is the point on Plane 6 and the A-pillar which is closest to CG-F1 for the nearest seating position.

#### S10.2 B-pillar targets.

(a) *B-pillar reference point and target BP1.* Locate the point (Point 3) on the vehicle interior at the intersection of the horizontal plane passing through the highest point of the forwardmost door opening and the centerline of the

width of the B-pillar, as viewed laterally. Locate a transverse vertical plane (Plane 7) which passes through Point 3. Locate the point (Point 4) at the intersection of the interior roof surface, Plane 7, and the plane, described in S8.15(h), defining the nearest edge of the upper roof. The B-pillar reference point (Point BPR) is the point located at the middle of the line from Point 3 to Point 4 in Plane 7, measured along the vehicle interior surface. Target BP1 is located at Point BPR.

(b) *Target BP2.* If a seat belt anchorage is located on the B-pillar, Target BP2 is located at any point on the anchorage.

(c) *Target BP3.* Target BP3 is located in accordance with this paragraph. Locate a horizontal plane (Plane 8) which intersects Point BPR. Locate a horizontal plane (Plane 9) which passes through the lowest point of the daylight opening forward of the pillar. Locate a horizontal plane (Plane 10) half-way between Plane 8 and Plane 9. Target BP3 is the point located in Plane 10 and on the interior surface of the B-pillar, which is closest to CG-F(2) for the nearest seating position.

(d) *Target BP4.* Locate a horizontal plane (Plane 11) half-way between Plane 9 and Plane 10. Target BP4 is the point located in Plane 11 and on the interior surface of the B-pillar which is closest to CG-R for the nearest seating position.

#### S10.3 Other pillar targets.

##### (a) *Target OP1.*

(1) Except as provided in S10.3(a)(2), target OP1 is located in accordance with this paragraph. Locate the point (Point 5), on the vehicle interior, at the intersection of the horizontal plane through the highest point of the highest adjacent door opening or daylight opening (if no adjacent door opening) and the centerline of the width of the other pillar, as viewed laterally. Locate a transverse vertical plane (Plane 12) passing through Point 5. Locate the point (Point 6) at the intersection of the interior roof surface, Plane 12 and the plane, described in S8.15(h), defining the nearest edge of the upper roof. The other pillar reference point (Point OPR) is the point located at the middle of the line between Point 5 and Point 6 in Plane 12, measured along the vehicle

interior surface. Target OP1 is located at Point OPR.

(2) If a seat belt anchorage is located on the pillar, Target OP1 is any point on the anchorage.

(b) *Target OP2.* Locate the horizontal plane (Plane 13) intersecting Point OPR. Locate a horizontal plane (Plane 14) passing through the lowest point of the daylight opening forward of the pillar. Locate a horizontal plane (Plane 15) half-way between Plane 13 and Plane 14. Target OP2 is the point located on the interior surface of the pillar at the intersection of Plane 15 and the centerline of the width of the pillar, as viewed laterally.

#### S10.4 Rearmost pillar targets

(a) *Rearmost pillar reference point and target RP1.* Locate the point (Point 7) at the corner of the upper roof nearest to the pillar. The distance between Point M, as described in S8.15(g), and Point 7, as measured along the vehicle interior surface, is D. Extend the line from Point M to Point 7 along the vehicle interior surface in the same vertical plane by  $(3 \cdot D/7)$  beyond Point 7 or until the edge of a daylight opening, whichever comes first, to locate Point 8. The rearmost pillar reference point (Point RPR) is at the midpoint of the line between Point 7 and Point 8, measured along the vehicle interior. Target RP1 is located at Point RPR.

##### (b) *Target RP2.*

(1) Except as provided in S10.4(b)(2), target RP2 is located in accordance with this paragraph. Locate the horizontal plane (Plane 16) through Point RPR. Locate the horizontal plane (Plane 17) 150 mm below Plane 16. Target RP2 is located in Plane 17 and on the pillar at the location closest to CG-R for the nearest designated seating position.

(2) If a seat belt anchorage is located on the pillar, Target RP2 is any point on the anchorage.

#### S10.5 Front header targets.

(a) *Target FH1.* Locate the contour line (Line 2) on the vehicle interior trim which passes through the APR and is parallel to the contour line (Line 3) at the upper edge of the windshield on the vehicle interior. Locate the point (Point 9) on Line 2 that is 125 mm inboard of the APR, measured along that line. Locate a longitudinal

vertical plane (Plane 18) that passes through Point 9. Target FH1 is located at the intersection of Plane 18 and the upper vehicle interior, halfway between a transverse vertical plane (Plane 19) through Point 9 and a transverse vertical plane (Plane 20) through the intersection of Plane 18 and Line 3.

(b) *Target FH2.*

(1) Except as provided in S10.5(b)(2), target FH2 is located in accordance with this paragraph. Locate a point (Point 10) 275 mm inboard of Point APR, along Line 2. Locate a longitudinal vertical plane (Plane 21) that passes through Point 10. Target FH2 is located at the intersection of Plane 21 and the upper vehicle interior, halfway between a transverse vertical plane (Plane 22) through Point 10 and a transverse vertical plane (Plane 23) through the intersection of Plane 21 and Line 3.

(2) If a sun roof opening is located forward of the front edge of the upper roof and intersects the mid-sagittal plane of a dummy seated in either front outboard seating position, target FH2 is the nearest point that is forward of a transverse vertical plane (Plane 24) through CG-F(2) and on the intersection of the mid-sagittal plane and the interior sunroof opening.

S10.6 *Targets on the side rail between the A-pillar and the B-pillar or rearmost pillar in vehicles with only two pillars on each side of the vehicle.*

(a) *Target SR1.* Locate a transverse vertical plane (Plane 25) 150 mm rearward of Point APR. Locate the point (Point 11) at the intersection of Plane 25 and the upper edge of the forwardmost door opening. Locate the point (Point 12) at the intersection of the interior roof surface, Plane 25 and the plane, described in S8.15(h), defining the nearest edge of the upper roof. Target SR1 is located at the middle of the line between Point 11 and Point 12 in Plane 25, measured along the vehicle interior.

(b) *Target SR2.* Locate a transverse vertical plane (Plane 26) 300 mm rearward of the APR or 300 mm forward of the BPR (or the RPR in vehicles with no B-pillar). Locate the point (Point 13) at the intersection of Plane 26 and the upper edge of the forwardmost door opening. Locate the point (Point 14) at the intersection of the interior roof

surface, Plane 26 and the plane, described in S8.15(h), defining the nearest edge of the upper roof. Target SR2 is located at the middle of the line between Point 13 and Point 14 in Plane 26, measured along the vehicle interior.

S10.7 *Other side rail target (target SR3).*

(a) Except as provided in S10.7(b), target SR3 is located in accordance with this paragraph. Locate a transverse vertical plane (Plane 27) 150 mm rearward of either Point BPR or Point OPR. Locate the point (Point 15) as provided in either S10.7(a)(1) or S10.7(a)(2), as appropriate. Locate the point (Point 16) at the intersection of the interior roof surface, Plane 27 and the plane, described in S8.15(h), defining the nearest edge of the upper roof. Target SR3 is located at the middle of the line between Point 15 and Point 16 in Plane 27, measured along the vehicle interior surface.

(1) If Plane 27 intersects a door or daylight opening, the Point 15 is located at the intersection of Plane 27 and the upper edge of the door opening or daylight opening.

(2) If Plane 27 does not intersect a door or daylight opening, the Point 15 is located on the vehicle interior at the intersection of Plane 27 and the horizontal plane through the highest point of the door or daylight opening nearest Plane 27. If the adjacent door(s) or daylight opening(s) are equidistant to Plane 27, Point 15 is located on the vehicle interior at the intersection of Plane 27 and either horizontal plane through the highest point of each door or daylight opening.

(b) Except as provided in S10.7(c), if a grab handle is located on the side rail, target SR3 is located at any point on the anchorage of the grab-handle. Folding grab-handles are in their stowed position for testing.

(c) If a seat belt anchorage is located on the side rail, target SR3 is located at any point on the anchorage.

S10.8 *Rear header target (target RH).* Locate the point (Point 17) at the intersection of the surface of the upper vehicle interior, the mid-sagittal plane (Plane 28) of the outboard rearmost dummy and the plane, described in S8.15(h), defining the rear edge of the upper roof. Locate the point (Point 18)



as provided in S10.8(a) or S10.8(b), as appropriate. Except as provided in S10.8(c), Target RH is located at the mid-point of the line that is between Point 17 and Point 18 and is in Plane 28, as measured along the surface of the vehicle interior.

(a) If Plane 28 intersects a rear door opening or daylight opening, then Point 18 is located at the intersection of Plane 28 and the upper edge of the door opening or the daylight opening (if no door opening).

(b) If Plane 28 does not intersect a rear door opening or daylight opening, then Point 18 is located on the vehicle interior at the intersection of Plane 28 and a horizontal plane through the highest point of the door or daylight opening nearest to Plane 28. If the adjacent door(s) or daylight opening(s) are equidistant to Plane 28, Point 18 is located on the vehicle interior at the intersection of Plane 28 and either horizontal plane through the highest point of each door or daylight opening.

(c) If Target RH is more than 112 mm from Point 18 on the line that is between Point 17 and Point 18 and is in Plane 28, as measured along the surface of the vehicle interior, then Target RH is the point on that line which is 112 mm from Point 18.

S10.9 *Upper roof target (target UR)*. Target UR is any point on the upper roof.

S10.10 *Sliding door track target (target SD)*. Locate the transverse vertical plane (Plane 29) passing through the middle of the widest opening of the sliding door, measured horizontally

and parallel to the vehicle longitudinal centerline. Locate the point (Point 19) at the intersection of the surface of the upper vehicle interior, Plane 29 and the plane, described in S8.15(h), defining the nearest edge of the upper roof. Locate the point (Point 20) at the intersection of Plane 29 and the upper edge of the sliding door opening. Target SD is located at the middle of the line between Point 19 and Point 20 in Plane 29, measured along the vehicle interior.

S10.11 *Roll-bar targets*.

(a) *Target RB1*. Locate a longitudinal vertical plane (Plane 30) at the mid-sagittal plane of a dummy seated in any outboard designated seating position. Target RB1 is located on the roll-bar and in Plane 30 at the location closest to either CG-F2 or CG-R, as appropriate, for the same dummy.

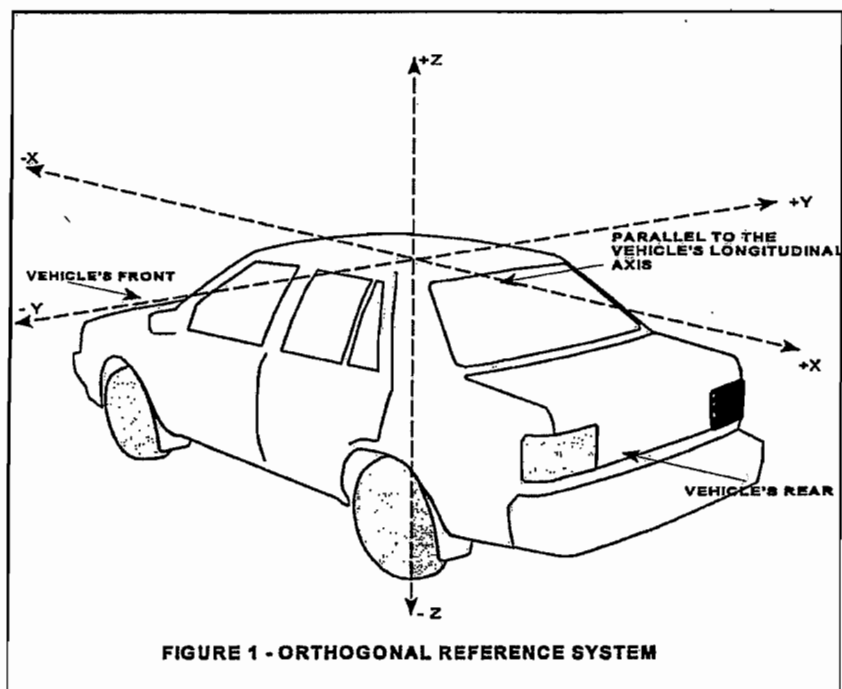
(b) *Target RB2*. If a seat belt anchorage is located on the roll-bar, Target RB2 is any point on the anchorage.

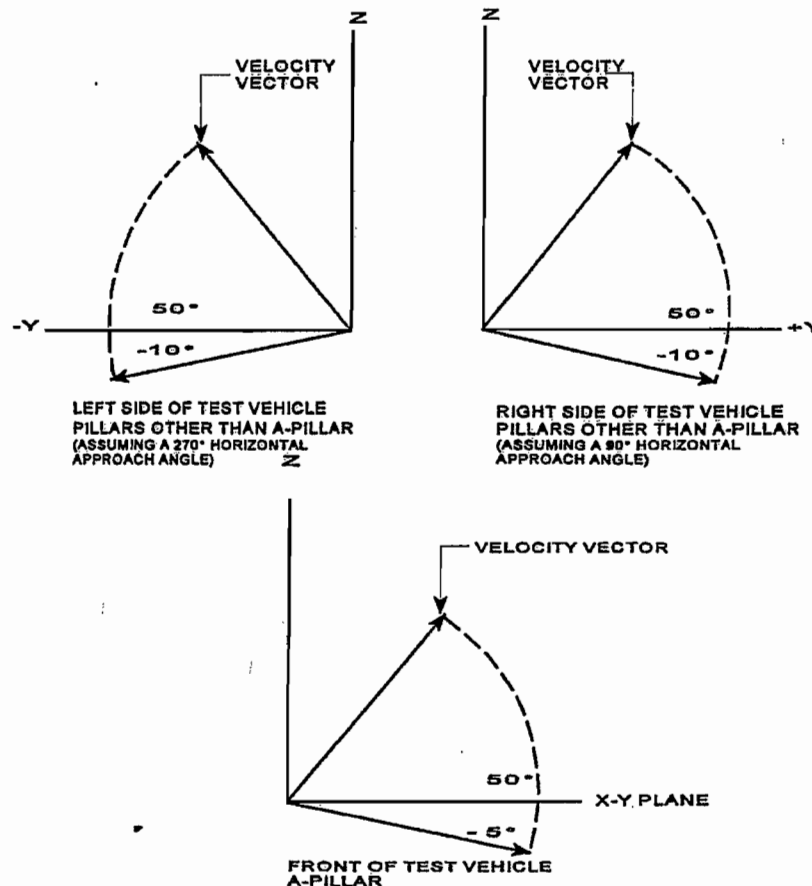
S10.12 *Stiffener targets*.

(a) *Target ST1*. Locate a transverse vertical plane (Plane 31) containing either CG-F2 or CG-R, as appropriate, for any outboard designated seating position. Target ST1 is located on the stiffener and in Plane 31 at the location closest to either CG-F2 or CG-R, as appropriate.

(b) *Target ST2*. If a seat belt anchorage is located on the stiffener, Target ST2 is any point on the anchorage.

S10.13 *Brace target (target BT)* Target BT is any point on the width of the brace as viewed laterally from inside the passenger compartment.





**VERTICAL AND HORIZONTAL APPROACH ANGLE PLANE  
FIGURE 2**

**S10.14 Door frame targets.**

(a) *Target DF1.* Locate the point (Point 21) on the vehicle interior at the intersection of the horizontal plane passing through the highest point of the forward door opening and a transverse vertical plane (Plane 32) tangent to the rearmost edge of the forward door, as viewed laterally with the adjacent door open. Locate the point (Point 22) at the intersection of the interior roof surface, Plane 32, and the plane, described in S8.15(h), defining the near-

est edge of the upper roof. The door frame reference point (Point DFR) is the point located at the middle of the line from Point 21 to Point 22 in Plane 32, measured along the vehicle interior surface. Target DF1 is located at Point DFR.

(b) *Target DF2.* If a seat belt anchorage is located on the door frame, Target DF2 is located at any point on the anchorage.

(c) *Target DF3.* Locate a horizontal plane (Plane 33) which intersects Point

DFR. Locate a horizontal plane (Plane 34) that passes through the lowest point of the adjacent daylight opening forward of the door frame. Locate a horizontal plane (Plane 35) half-way between Plane 33 and Plane 34. Target DF3 is the point located in Plane 35 and on the interior surface of the door frame, which is closest to CG-F2 for the nearest seating position.

(d) *Target DF4.* Locate a horizontal plane (Plane 36) half-way between Plane 34 and Plane 35. Target DF4 is the point located in Plane 36 and on the interior surface of the door frame that is closest to CG-R for the nearest seating position.

S10.15 *Other door frame targets.*

(a) *Target OD1.*

(1) Except as provided in S10.15(a)(2), target OD1 is located in accordance with this paragraph. Locate the point (Point 23) on the vehicle interior, at the intersection of the horizontal plane through the highest point of the highest adjacent door opening or daylight opening (if there is no adjacent door opening) and the center line of the width of the other door frame, as viewed laterally with the doors in the closed position. Locate a transverse vertical plane (Plane 37) passing through Point 23. Locate the point (Point 24) at the intersection of the interior roof surface, Plane 37 and the plane, described in S8.15(h), defining the nearest edge of the upper roof. The other door frame reference point (Point ODR) is the point located at the middle of the line between Point 23 and Point 24 in Plane 37, measured along the vehicle interior surface. Target OD1 is located at Point ODR.

(2) If a seat belt anchorage is located on the door frame, Target OD1 is any point on the anchorage.

(b) *Target OD2.* Locate the horizontal plane (Plane 38) intersecting Point ODR. Locate a horizontal plane (Plane 39) passing through the lowest point of the daylight opening forward of the door frame. Locate a horizontal plane (Plane 40) half-way between Plane 38 and Plane 39. Target OD2 is the point located on the interior surface of the door frame at the intersection of Plane 40 and the center line of the width of the door frames, as viewed laterally, with the doors in the closed position.

S10.16 *Seat belt mounting structure targets.*

(a) *Target SB1.* Target SB1 is located at any point on the seat belt anchorage mounted on the seat belt mounting structure.

(b) *Target SB2.* Locate a horizontal plane (Plane 41), containing either CG-F2 or CG-R, as appropriate, for any outboard designated seating position whose seating reference point, SgRP, is forward of and closest to, the vertical center line of the width of the seat belt mounting structure, as viewed laterally. Target SB2 is located on the seat belt mounting structure and in Plane 41 at the location closest to either CG-F2 or CG-R, as appropriate.

(c) *Target SB3.* Locate a horizontal plane (Plane 42), containing CG-R for any outboard designated seating position rearward of the forwardmost designated seating position or positions whose seating reference point, SgRP, is rearward of and closest to, the vertical center line of the width of the seat belt mounting structure, as viewed laterally. Locate a horizontal plane (Plane 43) 200 mm below Plane 42. Target SB3 is located on the seat belt mounting structure and in Plane 43 at the location closest to CG-R, as appropriate.

[62 FR 16725, Apr. 8, 1997; 63 FR 28, Jan. 2, 1998; 63 FR 41464, Aug. 4, 1998; 63 FR 45965, Aug. 28, 1998; 64 FR 7140, Feb. 12, 1999; 64 FR 69671, Dec. 14, 1999; 67 FR 41354, June 18, 2002; 67 FR 79439, Dec. 23, 2002; 68 FR 51711, Aug. 28, 2003; 69 FR 9226, Feb. 27, 2004; 69 FR 54249, Sept. 8, 2004; 69 FR 70914, Dec. 8, 2004; 70 FR 51873, Aug. 31, 2005]

**§ 571.202 Standard No. 202; Head restraints; Applicable at the manufacturers option until September 1, 2008.**

S1. *Purpose and scope.* This standard specifies requirements for head restraints to reduce the frequency and severity of neck injury in rear-end and other collisions.

S2. *Application.* This standard applies to passenger cars, and to multipurpose passenger vehicles, trucks and buses with a 4,536 kg or less, manufactured before September 1, 2008. Until September 1, 2008, manufacturers may comply with the standard in this § 571.202, with the European regulations

## Appendix C

### Guidance on the “Free Motion Headform Test” and its Application to Digital Video Systems, FMVSS 201, Sections 6.1-6.2

## **Guidance on the “Free Motion Headform Test” and its Application to Digital Video Systems, FMVSS 201, Sections 6.1-6.2**

The following information was put together to assist manufacturers of Digital Video Equipment with understanding the tests requested in Federal Motor Vehicle Safety Standard 210 “Occupant protection in interior impact” in the minimum specification document. This information is taken directly from that standard. The full standard can be located at:

[http://a257.g.akamaitech.net/7/257/2422/09nov20051500/edocket.access.gpo.gov/cfr\\_2005/octqtr/pdf/49cfr571.201.pdf](http://a257.g.akamaitech.net/7/257/2422/09nov20051500/edocket.access.gpo.gov/cfr_2005/octqtr/pdf/49cfr571.201.pdf). It is intended that manufacturers meet the requirements of Section 6.1-6.2 generally known as the “free motion headform test”. It is not intended for the purposes of this specification that manufacturers need conduct the test in Section 6.3, known as the “pole test”.

**NOTE:** This summary is not intended to relieve manufacturers of any responsibility for any other current or future legal requirements or obligations required under this or any other standard for the products they are selling. It is merely a guide for the free motion headform test specified in the minimum Digital Video Specification. You may be legally required to meet further and more stringent guidelines than stated herein. You should consult competent legal and engineering counsel on these issues.

As a note to manufacturers, the automakers through the Alliance of Automobile Manufacturers has entered into agreements for future crash worthiness requirements that may affect certain components and their locations and design in mobile Digital Video Systems. Further, certain requirements concerning side impact testing have been voluntarily agreed to by this group and may affect what is considered the “industry standard”.

### **§ 571.201 Standard No. 201; Occupant protection in interior impact.**

*S1. Purpose and scope.* This standard specifies requirements to afford impact protection for occupants.

*S2. Application.* This standard applies to passenger cars and to multipurpose passenger vehicles, trucks, and buses with a GVWR of 4,536 kilograms or less, except that the requirements of S6 do not apply to buses with a GVWR of more than 3,860 kilograms.

*S3. Definitions.*

*A-pillar* means any pillar that is entirely forward of a transverse vertical plane passing through the seating reference point of the driver’s seat.

*Ambulance* means a motor vehicle designed exclusively for the purpose of emergency medical care, as evidenced by the presence of a passenger compartment to accommodate emergency medical personnel, one or more patients on litters or cots, and equipment and supplies for emergency care at a location or during transport.

*B-pillar* means the forwardmost pillar on each side of the vehicle that is, in whole or in part, rearward of a transverse vertical plane passing through the seating reference point of the driver’s seat, unless:

- (1) There is only one pillar rearward of that plane and it is also a rearmost pillar; or
- (2) There is a door frame rearward of the A-pillar and forward of any other pillar or rearmost pillar.

*Brace* means a fixed diagonal structural member in an open body vehicle that is used to brace the roll-bar and that connects the roll-bar to the main body of the vehicle structure.

*Convertible* means a vehicle whose A-pillars are not joined with the B-pillars (or rearmost pillars) by a fixed, rigid structural member.

*Convertible roof frame* means the frame of a convertible roof.

*Convertible roof linkage mechanism* means any anchorage, fastener, or device necessary to deploy a convertible roof frame.

*Daylight opening* means, for openings on the side of the vehicle, other than a door opening, the locus of all points where a horizontal line, perpendicular to the vehicle longitudinal centerline, is tangent to the periphery of the opening. For openings on the front and rear of the vehicle, other than a door opening, *daylight opening* means the locus of all points where a horizontal line, parallel to the vehicle longitudinal centerline, is tangent to the periphery of the opening. If the horizontal line is tangent to the periphery at more than one point at any location, the most inboard point is used to determine the daylight opening.

*Door frame* means the rearmost perimeter structure, including trim but excluding glass, of the forward door and the forwardmost perimeter structure, including trim but excluding glass, of the rear door of a pair of adjacent side doors that:

- (1) Have opposing hinges;
- (2) Latch together without engaging or contacting an intervening pillar;
- (3) Are forward of any pillar other than the A-pillar on the same side of the vehicle; and
- (4) Are rearward of the A-pillar.

*Door opening* means, for door openings on the side of the vehicle, the locus of all points where a horizontal line, perpendicular to the vehicle longitudinal centerline, is tangent to the periphery of the side door opening. For door openings on the back end of the vehicle, *door opening* means the locus of all points where a horizontal line, parallel to the vehicle longitudinal centerline, is tangent to the periphery of the back door opening. If the horizontal line is tangent to the periphery at more than one point at any location, the most inboard point is the door opening.

*Dynamically deployed upper interior head protection system* means a protective device or devices which are integrated into a vehicle and which, when activated by an impact, provide, through means requiring no action from occupants, protection against head impacts with upper interior structures and components of the vehicle in crashes.

*Forehead impact zone* means the part of the free motion headform surface area that is determined in accordance with the procedure set forth in S8.10.

*Free motion headform* means a test device which conforms to the specifications of part 572, subpart L of this chapter.

*Interior rear quarter panel* means a vehicle interior component located between the rear edge of the side door frame, the front edge of the rearmost seat back, and the daylight opening.

*Mid-sagittal plane of a dummy* means a longitudinal vertical plane passing through the seating reference point of a designated seating position.

*Other door frame* means the rearmost perimeter structure, including trim but excluding glass, of the forward door and the forwardmost perimeter structure, including trim but excluding glass, of the rear door of a pair of adjacent side doors that:

- (1) Have opposing hinges;
- (2) Latch together without engaging or contacting an intervening pillar; and
- (3) Are rearward of the B-pillar.

*Other pillar* means any pillar which is not an A-pillar, a B-pillar, or a rearmost pillar.

*Pillar* means any structure, excluding glazing and the vertical portion of door window frames, but including accompanying moldings, attached components such as safety belt anchorages and coat hooks, which:

- (1) Supports either a roof or any other structure (such as a roll-bar) that is above the driver's head, or
- (2) Is located along the side edge of a window.

*Roll-bar* means a fixed overhead structural member, including its vertical support structure, that extends from the left to the right side of the passenger compartment of any open body vehicles and convertibles. It does not include a header.

*Seat belt anchorage* means any component involved in transferring seat belt loads to the vehicle structure, including, but not limited to, the attachment hardware, but excluding webbing or straps, seat frames, seat pedestals, and the vehicle structure itself, whose failure causes separation of the belt from the vehicle structure.

*Seat belt mounting structure* means:

- (a) A vehicle body or frame component, including trim, that incorporates an upper seat belt anchorage conforming to the requirements of S4.2.1 and S4.3.2 of 49 CFR 571.210, that is located rearward of the rearmost outboard designated seating position, and that extends above a horizontal plane 660 mm above the seating reference point (SgRP) of that seating position; and
- (b) A vehicle body or frame component, including trim, that incorporates an upper seat belt anchorage conforming to the requirements of S4.2.1 and S4.3.2 of 49 CFR 571.210, that is located forward of the rearmost outboard designated seating position, and that extends above a horizontal plane 460mm above the SgRP of that seating position located rearward of the anchorage.
- (c) The seat belt mounting structure is not a pillar, roll bar, brace or stiffener, side rail, seat, interior rear quarter panel, or part of the roof.

*Sliding door track* means a track structure along the upper edge of a side door opening that secures the door in the closed position and guides the door when moving to and from the open position.

*Stiffener* means a fixed overhead structural member that connects one roll-bar to another roll-bar or to a header of any open body vehicle or convertible.

*Upper roof* means the area of the vehicle interior that is determined in accordance with the procedure set forth in S8.15.

*Windshield trim* means molding of any material between the windshield glazing and the exterior roof surface, including material that covers a part of either the windshield glazing or exterior roof surface.

*S6 Requirements for upper interior components.*



S6.1 *Vehicles manufactured on or after September 1, 1998.* Except as provided in S6.3 and S6.1.4, for vehicles manufactured on or after September 1, 1998 and before September 1, 2002, a percentage of the manufacturer's production, as specified in S6.1.1, S6.1.2, or S6.1.3 shall conform, at the manufacturer's option, to either S6.1(a) or S6.1(b). For vehicles manufactured by final stage manufacturers on or after September 1, 1998 and before September 1, 2006, a percentage of the manufacturer's production as specified in S6.1.4 shall, except as provided in S6.3, conform, to either S6.1(a) or S6.1(b). The manufacturer shall select the option by the time it certifies the vehicle and may not thereafter select a different option for the vehicle.

(a) When tested under the conditions of S8, comply with the requirements specified in S7 at the target locations specified in S10 when impacted by the free motion headform specified in S8.9 at any speed up to and including 24 km/h (15 mph). The requirements do not apply to any target that cannot be located using the procedures of S10.

(b) When equipped with a dynamically deployed upper interior head protection system and tested under the conditions of S8, comply with the requirements specified in S7 at the target locations specified in S10 as follows:

(1) Targets that are not located over any point inside the area measured along the contour of the vehicle surface within 50 mm (2.0 inch) of the periphery of the stowed system projected perpendicularly onto the vehicle interior surface, including mounting and inflation components but exclusive of any cover or covers, shall be impacted by the free motion headform specified in S8.9 at any speed up to and including 24 km/h (15 mph). The requirements do not apply to any targets that can not be located by using the procedures of S10.

(2) Targets that are over any point inside the area measured along the contour of the vehicle interior within 50 mm (2.0 inch) of the periphery of the stowed system projected perpendicularly onto the vehicle interior surface, including mounting and inflation components but exclusive of any cover or covers, when the dynamically deployed upper interior head protection system is not deployed, shall be impacted by the free motion headform specified in S8.9 at any speed up to and including 19 km/h (12 mph) with the system undeployed. The requirements do not apply to any target that can not be located using the procedures of S10.

(3) Each vehicle shall, when equipped with a dummy test device specified in Part 572, Subpart M, and tested as specified in S8.16 through S8.28, comply with the requirements specified in S7 when crashed into a fixed, rigid pole of 254 mm in diameter, at any velocity between 24 kilometers per hour (15 mph) and 29 kilometers per hour (18 mph).

S7 *Performance Criterion.* The HIC(d) shall not exceed 1000 when calculated in accordance with the following formula:

$$HIC = \left[ \frac{1}{(t_2 - t_1)} \int_{t_1}^{t_2} a dt \right]^{2.5} (t_2 - t_1)$$

Where the term  $a$  is the resultant head acceleration expressed as a multiple of  $g$  (the acceleration of gravity), and  $t_1$  and  $t_2$  are any two points in time during the impact which are separated by not more than a 36 millisecond time interval.

(a) For the free motion headform;

$HIC(d)=0.75446$  (free motion headform HIC)+166.4.

(b) For the part 572, subpart M, anthropomorphic test dummy;

$HIC(d)=HIC$ .

#### *S8 Target location and test conditions.*

The vehicle shall be tested and the targets specified in S10 located under the following conditions.

##### *S8.1 Vehicle test attitude.*

(a) The vehicle is supported off its suspension at an attitude determined in accordance with S8.1(b).

(b) Directly above each wheel opening, determine the vertical distance between a level surface and a standard reference point on the test vehicle's body under the conditions of S8.1(b)(1) through S8.1(b)(3).

(1) The vehicle is loaded to its unloaded vehicle weight, plus its rated cargo and luggage capacity or 136 kg, whichever is less, secured in the luggage area. The load placed in the cargo area is centered over the longitudinal centerline of the vehicle.

(2) The vehicle is filled to 100 percent of all fluid capacities.

(3) All tires are inflated to the manufacturer's specifications listed on the vehicle's tire placard.

##### *S8.8 Temperature and humidity.*

(a) The ambient temperature is between 19 degrees C. and 26 degrees C., at any relative humidity between 10 percent and 70 percent.

(b) Tests are not conducted unless the headform specified in S8.9 is exposed to the conditions specified in S8.8(a) for a period not less than four hours.

*S8.9 Headform.* The headform used for testing conforms to the specifications of part 572, subpart L of this chapter.

*S8.10 Forehead impact zone.* The forehead impact zone of the headform is determined according to the procedure specified in (a) through (f).

(a) Position the headform so that the baseplate of the skull is horizontal. The midsagittal plane of the headform is designated as Plane S.

(b) From the center of the threaded hole on top of the headform, draw a 69 mm line forward toward the forehead, coincident with Plane S, along the contour of the outer skin of the headform. The front end of the line is designated as Point P. From Point P, draw a 100 mm line forward toward the forehead, coincident with Plane S, along the contour of the outer skin of the headform. The front end of the line is designated as Point O.

(c) Draw a 125 mm line which is coincident with a horizontal plane along the contour of the outer skin of the forehead from left to right through Point O so that the line is bisected at Point O. The end of the line on the left side of the headform is designated as Point a and the end on the right as Point b.

(d) Draw another 125 mm line which is coincident with a vertical plane along the contour of the outer skin of the forehead through Point P so that the line is bisected at Point P. The end of the line on the left side of the headform is designated as Point c and the end on the right as Point d.

(e) Draw a line from Point a to Point c along the contour of the outer skin of the headform using a flexible steel tape. Using the same method, draw a line from Point b to Point d.

(f) The forehead impact zone is the surface area on the FMH forehead bounded by lines a-O-b and c-P-d, and a-c and b-d.

S8.11 *Target circle.* The area of the vehicle to be impacted by the headform is marked with a solid circle 12.7 mm in diameter, centered on the targets specified in S10, using any transferable opaque coloring medium.

S8.12 *Location of head center of gravity.*

(a) *Location of head center of gravity for front outboard designated seating positions (CG-F).* For determination of head center of gravity, all directions are in reference to the seat orientation.

(1) *Location of rearmost CG-F (CG-F2).*

For front outboard designated seating positions, the head center of gravity with the seat in its rearmost normal design driving or riding position (CGF2) is located 160 mm rearward and 660 mm upward from the seating reference point.

(2) *Location of forwardmost CG-F (CGF1).*

For front outboard designated seating positions, the head center of gravity with the seat in its forwardmost adjustment position (CGF1) is located horizontally forward of CG-F2 by the distance equal to the fore-aft distance of the seat track.

(b) *Location of head center of gravity for rear outboard designated seating positions (CG-R).* For rear outboard designated seating positions, the head center of gravity (CG-R) is located 160 mm rearward, relative to the seat orientation, and 660 mm upward from the seating reference point.

S8.13 *Impact configuration.*

S8.13.1 The headform is launched from any location inside the vehicle which meets the conditions of S8.13.4. At the time of launch, the midsagittal plane of the headform is vertical and the headform is upright.

S8.13.2 The headform travels freely through the air, along a velocity vector that is perpendicular to the headform's skull cap plate, not less than 25 mm before making any contact with the vehicle.

S8.13.3 At the time of initial contact between the headform and the vehicle interior surface, some portion of the forehead impact zone of the headform must contact some portion of the target circle.

S8.13.4 *Approach angles.* The headform launching angle is as specified in Table 1. For components for which Table 1 specifies a range of angles, the headform launching angle is within the limits determined using the procedures specified in S8.13.4.1 and S8.13.4.2, and within the range specified in Table 1, using the orthogonal reference system specified in S9.

**TABLE 1—APPROACH ANGLE LIMITS (IN DEGREES)**

Target component	Horizontal Angle	Vertical angle
Front Header	180	0-50
Rear Header	0 or 360	0-50
Left Side Rail	270	0-50
Right Side Rail	90	0-50
Left Sliding Door Track	270	0-50
Right Sliding Door Track	90	0-50
Left A-Pillar	195-255	5-50
Right A-Pillar	105-165	5-50
Left B-Pillar	195-245	10-50
Right B-Pillar	15-165	10-50
Left Door Frame	195-245	10-50
Right Door Frame	15-165	10-50
Other Left Pillars	270	10-50
Other Right Pillars	90	10-50
Other Left Door Frame	270	10-50
Other Right Door Frame	90	10-50
Left Rearmost Pillar	270-345	10-50
Right Rearmost Pillar	15-90	10-50
Upper Roof	Any	0-50
Overhead Rollbar	0 or 180	0-50
Brace or Stiffener	90 or 270	0-50
Left Seat Belt Mounting Structure	195-245	10-50
Right Seat Belt Mounting Structure	15-165	10-50
Seat Belt Anchorages	Any	0-50

#### S8.14 *Multiple impacts.*

- (a) A vehicle being tested may be impacted multiple times, subject to the limitations in S8.14(b), (c), (d) and (e).
- (b) As measured as provided in S8.14(d), impacts within 300 mm of each other may not occur less than 30 minutes apart.
- (c) As measured as provided in S8.14(d), no impact may occur within 150 mm of any other impact.
- (d) For S8.14(b) and S8.14(c), the distance between impacts is the distance between the center of the target circle specified in S8.11 for each impact, measured along the vehicle interior.
- (e) No impact may occur within the “exclusion zone” of any pillar target specified in S10.1 through S10.4, door frame target specified in S10.14 and S10.15, upper roof target specified in S10.9, or seat belt mounting structure target specified in S10.16. The “exclusion zone” is determined according to the procedure in S8.14(f) through S8.14(k).
- (f) Locate the point, Point X, at the center of the target circle specified in S8.11 for the tested target.
- (g) Determine two spheres centered on Point X. Radii of these spheres are 150 mm and 200 mm, respectively.
- (h) Locate a horizontal plane passing through Point X. Determine the intersection points, if they exist, of the small sphere surface, the horizontal plane, and the vehicle interior surface. Relative to Point X, the point on the left is Point L and the point on the right is Point R.
- (i) Locate a vertical plane, Plane Z, passing through Point X and coincident (within  $\pm 5^\circ$ ) with the horizontal approach angle used or intended for use in testing the target centered on Point X.

(j) If either Point L or Point R does not exist, extend Line LX and/or Line RX, as appropriate, perpendicular to Plane Z beyond Point X by 150 mm. The end of the line is designated as Point L or Point R, as appropriate.

(k) Locate a vertical plane, Plane ZL, passing through Point L and parallel to Plane Z. Locate another vertical plane, Plane ZR, passing through Point R and parallel to Plane Z. The “exclusion zone” is the vehicle interior surface area between Plane ZL and Plane ZR below the upper boundary of the smaller sphere and above the lower boundary of the larger sphere. Points on the intersection of the vehicle interior surface and the large sphere below the target, the small sphere above the target, Plane ZL and Plane ZR are not included in the “exclusion zone.”

**S8.15 Upper Roof.** The upper roof of a vehicle is determined according to the procedure specified in S8.15 (a) through (h).

(a) Locate the transverse vertical plane A at the forwardmost point where it contacts the interior roof (including trim) at the vehicle centerline.

(b) Locate the transverse vertical plane B at the rearmost point where it contacts the interior roof (including trim) at the vehicle centerline.

(c) Measure the horizontal distance (D1) between Plane A and Plane B.

(d) Locate the vertical longitudinal plane C at the leftmost point at which a vertical transverse plane, located 300 mm rearward of the A-pillar reference point described in S10.1(a), contacts the interior roof (including trim).

(e) Locate the vertical longitudinal plane D at the rightmost point at which a vertical transverse plane, located 300 mm rearward of the A-pillar reference point described in S10.1(a), contacts the interior roof (including trim).

(f) Measure the horizontal distance (D2) between Plane C and Plane D.

(g) Locate a point (Point M) on the interior roof surface, midway between Plane A and Plane B along the vehicle longitudinal centerline.

(h) The upper roof zone is the area of the vehicle upper interior surface bounded by the four planes described in S8.15(h)(1) and S8.15(h)(2):

(1) A transverse vertical plane E located at a distance of (.35 D1) forward of Point M and a transverse vertical plane F located at a distance of (.35 D1) rearward of Point M, measured horizontally.

(2) A longitudinal vertical plane G located at a distance of (.35 D2) to the left of Point M and a longitudinal vertical plane H located at a distance of (.35 D2) to the right of Point M, measured horizontally.

**S9. Orthogonal Reference System.** The approach angles specified in S8.13.4 are determined using the reference system specified in S9.1 through S9.4. S9.1 An orthogonal reference system consisting of a longitudinal X axis and a transverse Y axis in the same horizontal plane and a vertical Z axis through the intersection of X and Y is used to define the horizontal direction of approach of the headform. The X-Z plane is the vertical longitudinal zero plane and is parallel to the longitudinal centerline of the vehicle. The XY plane is the horizontal zero plane parallel to the ground. The Y-Z plane is the vertical transverse zero plane that is perpendicular to the X-Y and X-Z planes. The X coordinate is negative forward of the Y-Z plane and positive to the rear. The Y coordinate is negative to the left of the X-Z plane and positive to the right. The Z coordinate is negative below the X-Y plane and positive above it. (See Figure 1.) S9.2

The origin of the reference system is the center of gravity of the headform at the time immediately prior to launch for each test. S9.3 The horizontal approach angle is the angle between the X axis and the headform impact velocity vector projected onto the horizontal zero plane, measured in the horizontal zero plane in the counter-clockwise direction. A 0 degree horizontal vector and a 360 degree horizontal vector point in the positive X direction; a 90 degree horizontal vector points in the positive Y direction; a 180 degree horizontal vector points in the negative X direction; and a 270 horizontal degree vector points in the negative Y direction. (See Figure 2.) S9.4 The vertical approach angle is the angle between the horizontal plane and the velocity vector, measured in the midsagittal plane of the headform. A 0 degree vertical vector in Table I coincides with the horizontal plane and a vertical vector of greater than 0 degrees in Table I makes an upward angle of the same number of degrees with that plane.

#### *S10 Target Locations.*

(a) The target locations specified in S10.1 through S10.16 are located on both sides of the vehicle and, except as specified in S10(b), are determined using the procedures specified in those paragraphs.

(b) Except as specified in S10(c), if there is no combination of horizontal and vertical angles specified in S8.13.4 at which the forehead impact zone of the free motion headform can contact one of the targets located using the procedures in S10.1 through S10.16, the center of that target is moved to any location within a sphere with a radius of 25 mm, centered on the center of the original target, which the forehead impact zone can contact at one or more combination of angles.

(c) If there is no point within the sphere specified in S10(b) which the forehead impact zone of the free motion headform can contact at one or more combination of horizontal and vertical angles specified in S8.13.4, the radius of the sphere is increased by 25 mm increments until the sphere contains at least one point that can be contacted at one or more combination of angles

#### *S10.6 Targets on the side rail between the A-pillar and the B-pillar or rearmost pillar in vehicles with only two pillars on each side of the vehicle.*

(a) *Target SR1.* Locate a transverse vertical plane (Plane 25) 150 mm rearward of Point APR. Locate the point (Point 11) at the intersection of Plane 25 and the upper edge of the forwardmost door opening. Locate the point (Point 12) at the intersection of the interior roof surface, Plane 25 and the plane, described in S8.15(h), defining the nearest edge of the upper roof. Target SR1 is located at the middle of the line between Point 11 and Point 12 in Plane 25, measured along the vehicle interior.

(b) *Target SR2.* Locate a transverse vertical plane (Plane 26) 300 mm rearward of the APR or 300 mm forward of the BPR (or the RPR in vehicles with no B-pillar). Locate the point (Point 13) at the intersection of Plane 26 and the upper edge of the forwardmost door opening. Locate the point (Point 14) at the intersection of the interior roof surface, Plane 26 and the plane, described in S8.15(h), defining the nearest edge of the upper roof. Target SR2 is located at the middle of the line between Point 13 and Point 14 in Plane 26, measured along the vehicle interior.

#### *S10.7 Other side rail target (target SR3).*

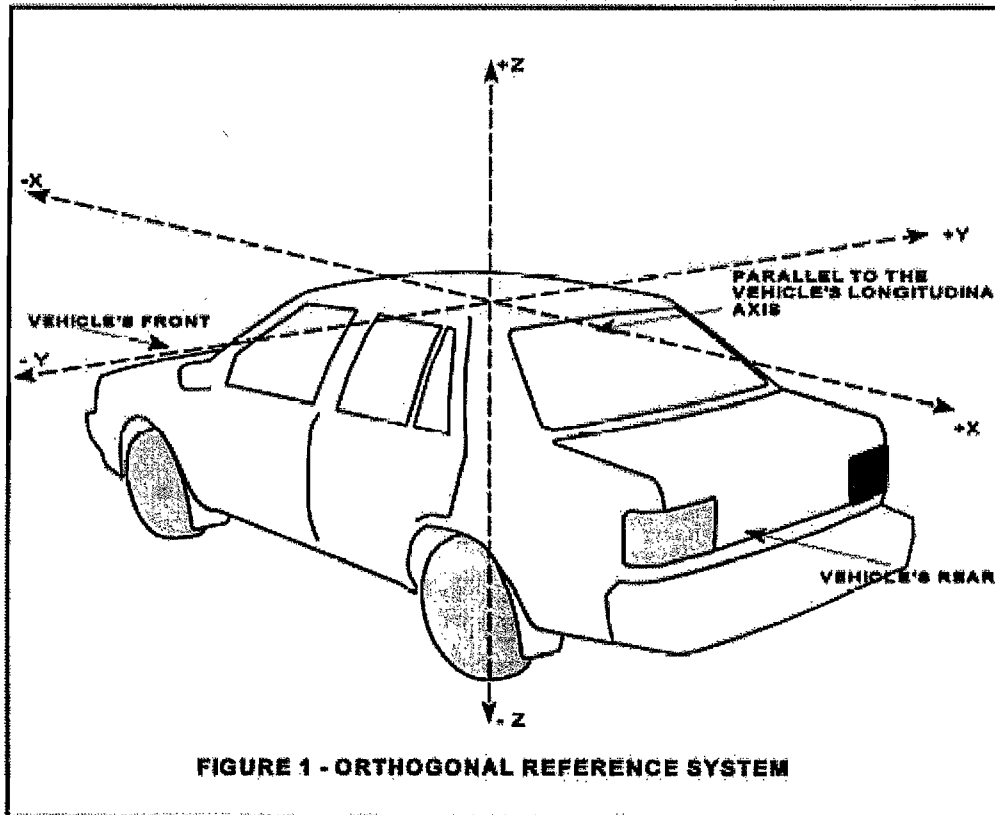
(a) Except as provided in S10.7(b), target SR3 is located in accordance with this paragraph. Locate a transverse vertical plane (Plane 27) 150 mm rearward of either Point BPR or Point OPR. Locate the point (Point 15) as provided in either S10.7(a)(1) or S10.7(a)(2), as appropriate. Locate the point (Point 16) at the intersection of the interior roof surface, Plane 27 and the plane, described in S8.15(h), defining the nearest edge of the upper roof. Target SR3 is located at the middle of the line between Point 15 and Point 16 in Plane 27, measured along the vehicle interior surface.

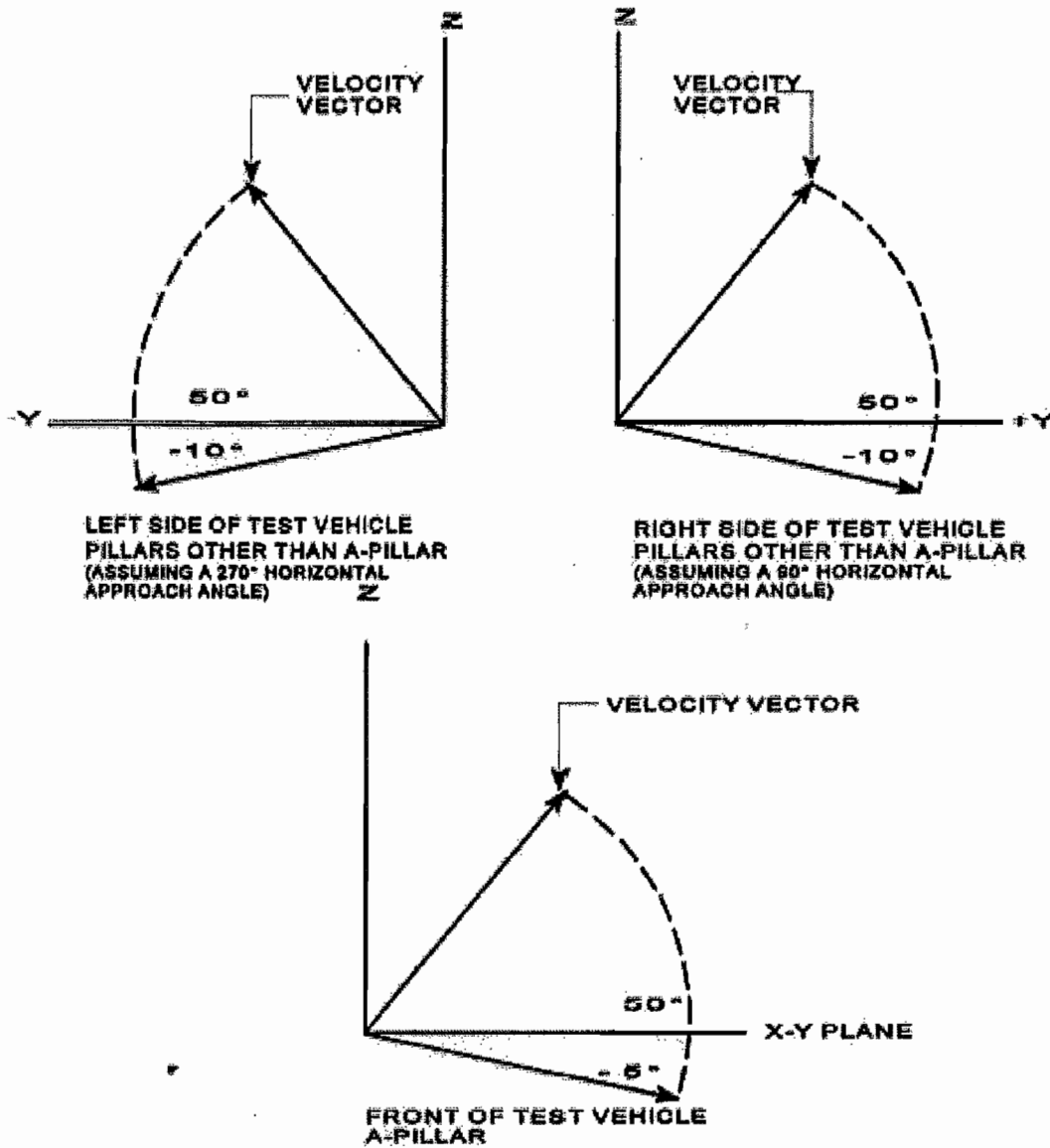
(1) If Plane 27 intersects a door or daylight opening, the Point 15 is located at the intersection of Plane 27 and the upper edge of the door opening or daylight opening.

(2) If Plane 27 does not intersect a door or daylight opening, the Point 15 is located on the vehicle interior at the intersection of Plane 27 and the horizontal plane through the highest point of the door or daylight opening nearest Plane 27. If the adjacent door(s) or daylight opening(s) are equidistant to Plane 27, Point 15 is located on the vehicle interior at the intersection of Plane 27 and either horizontal plane through the highest point of each door or daylight opening.

(b) Except as provided in S10.7(c), if a grab handle is located on the side rail, target SR3 is located at any point on the anchorage of the grab-handle. Folding grab-handles are in their stowed position for testing.

(c) If a seat belt anchorage is located on the side rail, target SR3 is located at any point on the anchorage.





**VERTICAL AND HORIZONTAL APPROACH ANGLE PLANE  
FIGURE 2**



## Appendix D

### Federal Motor Vehicle Safety Standards 205 “Glazing Materials”

[Code of Federal Regulations]

[Title 49, Volume 5]

[Revised as of October 1, 2001]

From the U.S. Government Printing Office via GPO Access

[CITE: 49CFR571.205]

[Page 462-467]

## TITLE 49--TRANSPORTATION

### CHAPTER V--NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, DEPARTMENT OF TRANSPORTATION

#### PART 571--FEDERAL MOTOR VEHICLE SAFETY STANDARDS--Table of Contents

##### Subpart B--Federal Motor Vehicle Safety Standards

#### Sec. 571.205 Standard No. 205, Glazing materials.

S1. Scope. This standard specifies requirements for glazing materials for use in motor vehicles and motor vehicle equipment.

S2. Purpose. The purpose of this standard is to reduce injuries resulting from impact to glazing surfaces, to ensure a necessary degree of transparency in motor vehicle windows for driver visibility, and to minimize the possibility of occupants being thrown through the vehicle windows in collisions.

S3. Application. This standard applies to glazing materials for use in passenger cars, multipurpose passenger vehicles, trucks, buses, motorcycles, slide-in campers, and pickup covers designed to carry persons while in motion.

#### S4. Definitions.

Bullet resistant shield means a shield or barrier that is installed completely inside a motor vehicle behind and separate from glazing materials that independently comply with the requirements of this standard.

Camper means a structure designed to be mounted in the cargo area

of  
a truck, or attached to an incomplete vehicle with motive power, for  
the  
purpose of providing shelter for persons.

Glass-plastic glazing material means a laminate of one or more  
layers of glass and one or more layers of plastic in

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which a plastic surface of the glazing faces inward when the glazing  
is  
installed in a vehicle.

Motor home means a multipurpose passenger vehicle that provides  
living accommodations for persons.

Pickup cover means a camper having a roof and sides but without a  
floor, designed to be mounted on and removable from the cargo area of  
a  
truck by the user.

Slide-in camper means a camper having a roof, floor, and sides,  
designed to be mounted on and removable from the cargo area of a  
truck  
by the user.

#### S5. Requirements.

##### S5.1 Materials.

S5.1.1 Glazing materials for use in motor vehicles, except as  
otherwise provided in this standard shall conform to the American  
National Standard ``Safety Code for Safety Glazing Materials for  
Glazing  
Motor Vehicles Operating on Land Highways'' Z-26.1-1977, January 26,  
1977, as supplemented by Z26.1a, July 3, 1980 (hereinafter referred  
to  
as ``ANS Z26''). However, Item 11B glazing as specified in that  
standard  
may not be used in motor vehicles at levels requisite for driving  
visibility, and Item 11B glazing is not required to pass Test Nos.  
17,  
30, and 31.

S5.1.1.1 The chemicals specified for testing chemical resistance  
in  
Tests Nos. 19 and 20 of ANS Z26 shall be:

- (a) One percent solution of nonabrasive soap.
- (b) Kerosene.
- (c) Undiluted denatured alcohol, Formula SD No. 30 (1 part 100-

percent methyl alcohol in 10 parts 190-proof ethyl alcohol by volume).

(d) Gasoline, ASTM Reference Fuel C, which is composed of Isooctane 50 volume percentage and Toluene 50 volume percentage. Isooctane must conform to A2.7 in Annex 2 of the Motor Fuels Section of the 1985 Annual

Book of ASTM Standards, Vol. 05.04, and Toluene must conform to ASTM Specification D362-84, Standard Specification for Industrial Grade Toluene. ASTM Reference Fuel C must be used as specified in:

(1) Paragraph A2.3.2 and A2.3.3 of Annex 2 of Motor Fuels, Section 1

in the 1985 Annual Book of ASTM Standards; and

(2) OSHA Standard 29 CFR 1910.106--`Handling Storage and Use of Flammable Combustible Liquids.''

This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51.

Copies may be inspected at the Technical Reference Library, NHTSA, 400

Seventh Street, SW., Room 5108, Washington, DC 20590, or at the Office

of the Federal Register, 800 North Capitol Street, NW., suite 700, Washington, DC.

S5.1.1.2 The following locations are added to the lists specified

in ANS Z26 in which item 4, item 5, item 8, and item 9 safety glazing may be used:

(a)--(i) [Reserved]

(j) Windows and doors in motor homes, except for the windshield and windows to the immediate right or left of the driver.

(k) Windows and doors in slide-in campers and pickup covers.

(l) Windows and doors in buses except for the windshield, windows to the immediate right or left of the driver, and rearmost windows if used for driving visibility.

(m) For Item 5 safety glazing only: Motorcycle windscreens below the intersection of a horizontal plane 380 millimeters vertically above the lowest seating position.

S5.1.1.3 The following locations are added to the lists specified

in ANS Z26 in which item 6 and item 7 safety glazing may be used:

(a) -- (i) [Reserved]

(j) Windows and doors in motor homes, except for the windshield, forward-facing windows, and windows to the immediate right or left of the driver.

(k) Windows, except forward-facing windows, and doors in slide-in campers and pickup covers.

(l) For item 7 safety glazing only:

(1) Standee windows in buses.

(2) Interior partitions.

(3) Openings in the roof.

S5.1.1.4 The following locations are added to the lists specified

in ANS Z26 in which item 8 and item 9 safety glazing may be used:

(a) -- (e) [Reserved]

(f) Windows and doors in motor homes, except for the windshield and

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windows to the immediate right or left of the driver.

(g) Windows and doors in slide-in campers and pickup covers.

S5.1.1.5 The phrase ``readily removable'' windows as defined in ANS

Z26, for the purposes of this standard, in buses having a GVWR of more

than 4536 kilograms, shall include pushout windows and windows mounted

in emergency exists that can be manually pushed out of their location in

the vehicle without the use of tools, regardless of whether such windows

remain hinged at one side to the vehicle.

S5.1.1.6 Multipurpose passenger vehicles. Except as otherwise specifically provided by this standard, glazing for use in multipurpose

passenger vehicles shall conform to the requirements for glazing for use

in trucks as specified in ANS Z26.

S5.1.1.7 Test No. 17 is deleted from the list of tests specified in

ANS Z26 for Item 5 glazing material and Test No. 18 is deleted from the lists of tests specified in ANS Z26 for Item 3 and Item 9 glazing material.

S5.1.2 In addition to the glazing materials specified in ANS Z26, materials conforming to S5.1.2.1, S5.1.2.2, S5.1.2.3, S5.1.2.4, S5.1.2.5, S5.1.2.6, S5.1.2.7, S5.1.2.8 and S5.1.2.11 may be used in the locations of motor vehicles specified in those sections.

S5.1.2.1 Item 11C--Safety Glazing Material for Use in Bullet Resistant Shields. Bullet resistant glazing that complies with Test Nos. 2, 17, 19, 20, 21, 24, 27, 28, 29, 30 and 32 of ANS Z26 and the labeling requirements of S5.1.2.5 may be used only in bullet resistant shields that can be removed from the motor vehicle easily for cleaning and maintenance. A bullet resistant shield may be used in areas requisite for driving visibility only if the combined parallel luminous transmittance with perpendicular incidence through both the shield and the permanent vehicle glazing is at least 60 percent.

S5.1.2.2 Item 12--Rigid Plastics. Safety plastics materials that comply with Test Nos. 10, 13, 16, 19, 20, 21 and 24 of ANS Z26, with the exception of the test for resistance to undiluted denatured alcohol Formula SD No. 30, and that comply with the labeling requirements of S5.1.2.5, may be used in a motor vehicle only in the following specified locations at levels not requisite for driving visibility.

- (a) Window and doors in slide-in campers and pick-up covers.
- (b) Motorcycle windscreens below the intersection of a horizontal plane 380 millimeters vertically above the lowest seating position.
- (c) Standee windows in buses.
- (d) Interior partitions.
- (e) Openings in the roof.
- (f) Flexible curtains or readily removable windows or in ventilators used in conjunction with readily removable windows.
- (g) Windows and doors in motor homes, except for the windshield and windows to the immediate right or left of the driver.
- (h) Windows and doors in buses except for the windshield and

window

to the immediate right and left of the driver.

S5.1.2.3 Item 13--Flexible plastics. Safety plastic materials that comply with Tests Nos. 16, 19, 20, 22, and 23 or 24 of ANS Z26, with the exception of the test for resistance to undiluted denatured alcohol Formula SD No. 30, and that comply with the labeling requirements of S5.1.2.5 may be used in the following specific locations at levels not requisite for driving visibility.

(a) Windows, except forward-facing windows, and doors in slide-in campers and pick-up covers.

(b) Motorcycle windscreens below the intersection of a horizontal plane 380 millimeters vertically above the lowest seating position.

(c) Standee windows in buses.

(d) Interior partitions.

(e) Openings in the roof.

(f) Flexible curtains or readily removable windows or in ventilators used in conjunction with readily removable windows.

(g) Windows and doors in motor homes, except for the windshield, forward-facing windows, and windows to the immediate right or left of the driver.

S5.1.2.4. Item 14--Glass Plastics. Glass-plastic glazing materials that comply with the labeling requirements of S5.1.2.10 and Test Nos. 1, 2, 3, 4, 9, 12, 15, 16, 17, 18, 19, 24, 26, and 28, as those

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tests are modified in S5.1.2.9, Test Procedures for Glass-Plastics, may be used anywhere in a motor vehicle, except that it may not be used in windshields of any of the following vehicles: convertibles, vehicles that have no roof, vehicles whose roofs are completely removable.

S5.1.2.5. Item 15A--Annealed Glass-Plastic for use in all Positions in a Vehicle Except the Windshield. Glass-plastic glazing materials that comply with Test Nos. 1, 2, 3, 4, 9, 12, 16, 17, 18, 19, 24, and 28,

as

those tests are modified in S5.1.2.9 Test Procedures for Glass-Plastics,

may be used anywhere in a motor vehicle except the windshield.

S5.1.2.6 Item 15B--Tempered Glass-Plastic for Use in All Positions

In a Vehicle Except the Windshield. Glass-plastic glazing materials that

comply with Tests Nos. 1, 2, 3, 4, 6, 7, 8, 16, 17, 18, 19, 24, and 28,

as those tests are modified in S5.1.2.9 Test Procedures for Glass-Plastics, may be used anywhere in a motor vehicle except the windshield.

S5.1.2.7. Item 16A--Annealed Glass-Plastic for Use in all Positions

in a Vehicle not Requisite for Driving Visibility. Glass-plastic glazing

materials that comply with Test Nos. 3, 4, 9, 12, 16, 19, 24, and 28, as

those tests are modified in S5.1.2.9 Test Procedures for Glass-Plastics,

may be used in a motor vehicle in all locations not requisite for driving visibility.

S5.1.2.8. Item 16B--Tempered Glass-Plastic for Use in all Positions

in a Vehicle not Requisite for Driving Visibility. Glass-plastic glazing

materials that comply with Test Nos. 3, 4, 6, 7, 8, 16, 19, 24, and 28,

as those tests are modified in S5.1.2.9 Test Procedures for Glass-Plastics, may be used in a motor vehicle in all locations not requisite for driving visibility.

S5.1.2.9 Test Procedures for Glass-Plastics. (a) Tests Nos. 6, 7, 8,

9, 12, 16, and 18 shall be conducted on the glass side of the specimen,

i.e., the surface which would face the exterior of the vehicle. Tests Nos. 17, 19, 24, and 26 shall be conducted on the plastic side of the specimen, i.e., the surface which would face the interior of the vehicle. Test No. 15 should be conducted with the glass side of the glazing facing the illuminated box and the screen, respectively. For Test No. 19, add the following to the specified list: an aqueous



solution of isopropanol and glycol ether solvents in concentration no greater than 10% or less than 5% by weight and ammonium hydroxide no greater than 5% or less than 1% by weight, simulating typical commercial windshield cleaner.

(b) Glass-plastic specimens shall be exposed to an ambient air temperature of -40 degrees Celsius (plus or minus 5 degrees Celsius), for a period of 6 hours at the commencement of Test No. 28, rather than at the initial temperature specified in that test. After testing, the glass-plastic specimens shall show no evidence of cracking, clouding, delaminating, or other evidence of deterioration.

(c) Glass-plastic specimens tested in accordance with Test No. 17 shall be carefully rinsed with distilled water following the abrasion procedure and wiped dry with lens paper. After this procedure, the arithmetic means of the percentage of light scattered by the three specimens as a result of abrasion shall not exceed 4.0 percent.

(d) Data obtained from Test No. 1 should be used when conducting Test No. 2.

(e) (1) Except as provided in S5.1.2.9(e) (2), glass-plastic glazing specimens tested in accordance with Test Nos. 9, 12 and 26 shall be clamped in the test fixture in Figure 1 of this standard in the manner shown in that figure. The clamping gasket shall be made of rubber 3 millimeters (mm) thick of hardness 50 IRHD (International Rubber Hardness Degrees), plus or minus five degrees. Movement of the test specimen, measured after the test, shall not exceed 2 mm at any point along the inside periphery of the fixture. Movement of the test specimen beyond the 2 mm limit shall be considered an incomplete test, not a test failure. A specimen used in such an incomplete test shall not be retested.

(2) At the option of the manufacturer, glass-plastic glazing specimens tested in accordance with Test Nos. 9 and 12 may be tested unclamped. Such specimens shall be tested using the fixture in Figure 1 of the standard, including the upper frame (unclamped) which holds the specimen in place.

S5.1.2.10 Cleaning instructions. (a) Each manufacturer of glazing materials designed to meet the requirements of S5.1.2.1, S5.1.2.2, S5.1.2.3, S5.1.2.4, S5.1.2.5, S5.1.2.6, S5.1.2.7, S5.1.2.8, or S5.1.2.11

shall affix a label, removable by hand without tools, to each item of glazing materials. The label shall identify the product involved, specify instructions and agents for cleaning the material that will minimize the loss of transparency, and instructions for removing frost

and ice, and, at the option of the manufacturer, refer owners to the vehicle's Owners Manual for more specific cleaning and other instructions.

(b) Each manufacturer of glazing materials designed to meet the requirements of paragraphs S5.1.2.4, S5.1.2.5, S5.1.2.6, S5.1.2.7, or S5.1.2.8 may permanently and indelibly mark the lower center of each item of such glazing material, in letters not less than 4.5 millimeters

nor more than 6 millimeters high, the following words, GLASS PLASTIC MATERIAL--SEE OWNER'S MANUAL FOR CARE INSTRUCTIONS.

S5.1.2.11 Test procedures for Item 4A--Rigid Plastic for Use in Side Windows Rearward of the ``C'' pillar. (a) Glazing materials that comply with Tests Nos. 2, 10, 13, 16, 17, as that test is modified in S5.1.2.9(c) (on the interior side only), 17, as that test is modified in

paragraph (b) of this section (on the exterior side only), 19, 20, 21,

and 24 of ANS Z26.1, may be used in the following specific locations:

(1) All areas in which Item 4 safety glazing may be used.

(2) Any side window that meets the criteria in S5.1.2.11(a) (2) (i) and (ii):

(i) Is in a vehicle whose rearmost designated seating position is forward-facing and cannot be adjusted so that it is side or rear-facing;

and

(ii) The forwardmost point on its visible interior surface is rearward of the vertical transverse plane that passes through the shoulder reference point (as described in Figure 1 of Sec. 571.210 Seat

belt assembly anchorages) of that rearmost seating position.

(b) (1) The initial maximum haze level shall not exceed 1.0 percent.

The specimens are subjected to abrasion for 100 cycles and then carefully wiped with dry lens paper (or its equivalent). The light scattered by the abraded track is measured in accordance with Test 17.

The arithmetic mean of the percentages of light scattered by the three specimens shall not exceed 4.0 percent after being subjected to abrasion for 100 cycles.

(2) The specimen is remounted on the specimen holder so that it rotates substantially in a plane and subjected to abrasion for an additional 400 cycles on the same track already abraded for 100 cycles.

Specimens are carefully wiped after abrasion with dry lens paper (or its equivalent). The light scattered by the abraded track is then measured as specified in Test 17. The arithmetic mean of the percentages of light scattered by the three specimens shall not exceed 10.0 percent after being subjected to abrasion for 500 cycles.

S5.2 Edges. In vehicles except schoolbuses, exposed edges shall be treated in accordance with SAE Recommended Practice J673a, ``Automotive Glazing'', August 1967. In schoolbuses, exposed edges shall be banded.

#### S6. Certification and marking.

S6.1 Each prime glazing material manufacturer, except as specified below, shall mark the glazing materials it manufactures in accordance with section 6 of ANS Z26. The materials specified in S5.1.2.1, S5.1.2.2, S5.1.2.3, S5.1.2.4, S5.1.2.5, S5.1.2.6, S5.1.2.7, S5.1.2.8, and S5.1.2.11 shall be identified by the marks ``AS 11C'', ``AS 12'', ``AS 13'', ``AS 14'', ``AS 15A'', ``AS 15B'', ``AS 16A'', ``AS 16B'', and ``AS 4A'', respectively. A prime glazing material manufacturer is one which fabricates, laminates, or tempers the glazing material.

S6.2 Each prime glazing material manufacturer shall certify each piece of glazing material to which this standard applies that is designed as a component of any specific motor vehicle or camper, pursuant to section 114 of the National Traffic and Motor Vehicle Safety

Act of 1966, by adding to the mark required by S6.1 in letters and numerals of the size specified in section 6 of ANS Z26, the symbol

``DOT'' and a manufacturer's code mark, which will be assigned by the NHTSA on the written request of the manufacturer.

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S6.3 Each prime glazing material manufacturer shall certify each piece of glazing material to which this standard applies that is designed to be cut into components for use in motor vehicles or items of motor vehicle equipment, pursuant to section 114 of the National Traffic and Motor Vehicle Safety Act.

S6.4 Each manufacturer or distributor who cuts a section of glazing material to which this standard applies, for use in a motor vehicle or camper, shall mark that material in accordance with section 6 of ANSI Z26.

S6.5 Each manufacturer or distributor who cuts a section of glazing material to which this standard applies, for use in a motor vehicle or camper, shall certify that his product complies with this standard in accordance with section 114 of the National Traffic and Motor Vehicle Safety Act.

[GRAPHIC] [TIFF OMITTED] TC01AU91.076

[37 FR 12239, June 21, 1972, as amended at 37 FR 13097, July 1, 1972; 37

FR 24036, Nov. 11, 1972; 37 FR 24826, Nov. 22, 1972; 42 FR 61466, Dec.

5, 1977; 45 FR 47151, July 14, 1980; 46 FR 43690, Aug. 31, 1981; 48 FR

52065, Nov. 16, 1983; 49 FR 6734, Feb. 23, 1984; 56 FR 12674, Mar. 27,

1991; 56 FR 18531, Apr. 23, 1991; 56 FR 49149, Sept. 27, 1991; 57 FR 1654, Jan. 15, 1992; 57 FR 13656, Apr. 17, 1992; 57 FR 30164, July 8, 1992; 57 FR 58150, Dec. 9, 1992; 60 FR 13646, Mar. 14, 1995; 61 FR 41743, Aug. 12, 1996]

## Appendix E

### Federal Motor Vehicle Safety Standards 101 “Controls and Displays”

[Code of Federal Regulations]

[Title 49, Volume 5]

[Revised as of October 1, 2001]

From the U.S. Government Printing Office via GPO Access

[CITE: 49CFR571.101]

[Page 190-195]

TITLE 49--TRANSPORTATION

CHAPTER V--NATIONAL HIGHWAY TRAFFIC  
SAFETY ADMINISTRATION, DEPARTMENT  
OF TRANSPORTATION

PART 571--FEDERAL MOTOR VEHICLE SAFETY STANDARDS--Table of Contents

Subpart B--Federal Motor Vehicle Safety Standards

Sec. 571.101 Standard No. 101; Controls and displays.

Source: 36 FR 22902, Dec. 2, 1971, unless otherwise noted.

S1. Scope. This standard specifies requirements for the location, identification, and illumination of motor vehicle controls and displays.

S2. Purpose. The purpose of this standard is to ensure the accessibility and visibility of motor vehicle controls and displays and to facilitate their selection under daylight and nighttime conditions, in order to reduce the safety hazards caused by the diversion of the driver's attention from the driving task, and by mistakes in selecting controls.

S3. Application. This standard applies to passenger cars, multipurpose passenger vehicles, trucks, and buses.

S4. Definitions.

Telltale means a display that indicates the actuation of a device, a correct or defective functioning or condition, or a failure to function.

Gauge means a display that is listed in S5.1 or in Table 2 and is not a telltale.

S5 Requirements. Each passenger car, multipurpose passenger vehicle, truck and bus manufactured with any control listed in S5.1 or in column 1 of Table 1, and each passenger car, multipurpose passenger vehicle and truck or bus less than 4,536 kg. GVWR with any display listed in S5.1 or in column 1 of Table 2, shall meet the requirements of this standard for the location, identification, and illumination of such control or display.

S5.1 Location. Under the conditions of S6, each of the following controls that is furnished shall be operable by the driver and each of the following displays that is furnished shall be visible to the driver. Under the conditions of S6, telltales are considered visible when activated.

#### Hand-Operated Controls

- (a) Steering wheel.
- (b) Horn.
- (c) Ignition.
- (d) Headlamp.
- (e) Taillamp.
- (f) Turn signal.
- (g) Illumination intensity.
- (h) Windshield wiper.
- (i) Windshield washer.
- (j) Manual transmission shift lever, except transfer case.
- (k) Windshield defrosting and defogging system.
- (l) Rear window defrosting and defogging system.
- (m) Manual choke.
- (n) Driver's sun visor.
- (o) Automatic vehicle speed system.

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- (p) Highbeam.

- (q) Hazard warning signal.
- (r) Clearance lamps.
- (s) Hand throttle.
- (t) Identification lamps.

#### Foot-Operated Controls

- (a) Service brake.
- (b) Accelerator.
- (c) Clutch.
- (d) Highbeam.
- (e) Windshield washer.
- (f) Windshield wiper.

#### Displays

- (a) Speedometer.
- (b) Turn signal.
- (c) Gear position.
- (d) Brake failure warning.
- (e) Fuel.
- (f) Engine coolant temperature.
- (g) Oil.
- (h) Highbeam.
- (i) Electrical charge.

#### S5.2 Identification.

##### S5.2.1 Vehicle controls shall be identified as follows:

(a) Except as specified in S5.2.1(b), any hand-operated control listed in column 1 of Table 1 that has a symbol designated for it in column 3 of that table shall be identified by either the symbol designated in column 3 (or symbol substantially similar in form to that shown in column 3) or the word or abbreviation shown in column 2 of that table. Any such control for which no symbol is shown in Table 1 shall be identified by the word or abbreviation shown in column 2. Words or symbols in addition to the required symbol, word or abbreviation may be used at the manufacturer's discretion for the purpose of clarity. Any such control for which column 2 of Table 1 and/or column 3 of Table 1 specifies ``Mfr. Option'' shall be identified by the manufacturer's



choice of a symbol, word or abbreviation, as indicated by that specification in column 2 and/or column 3. The identification shall be placed on or adjacent to the control. The identification shall, under the conditions of S6, be visible to the driver and, except as provided in S5.2.1.1, S5.2.1.2, and S5.2.1.3, appear to the driver perceptually upright.

(b) S5.2.1(a) does not apply to a turn signal control which is operated in a plane essentially parallel to the face plane of the steering wheel in its normal driving position and which is located on the left side of the steering column so that it is the control on that side of the column nearest to the steering wheel face plane.

S5.2.1.1 The identification of the following need not appear to the driver perceptually upright:

(a) A master lighting switch or headlamp and tail lamp control that adjusts control and display illumination by means of rotation, or any other rotating control that does not have an off position.

(b) A horn control.

S5.2.1.2 The identification of a rotating control other than one described by S5.2.1.1 shall appear to the driver perceptually upright when the control is in the off position.

S5.2.1.3 The identification of an automatic vehicle speed control located on the steering wheel, including the steering wheel hub and spokes, need not appear to the driver perceptually upright except when the vehicle, aligned to the manufacturer's specifications, has its wheels positioned for the vehicle to travel in a straight forward direction.

S5.2.2 Identification shall be provided for each function of any automatic vehicle speed system control and any heating and air conditioning system control, and for the extreme positions of any such control that regulates a function over a quantitative range. If this identification is not specified in Table 1 or 2, it shall be in word or symbol form unless color coding is used. If color coding is used to identify the extreme positions of a temperature control, the hot

extreme

shall be identified by the color red and the cold extreme by the color blue.

Example 1. A slide lever controls the temperature of the air in the vehicle heating system over a continuous range, from no heat to maximum heat. Since the control regulates a single function over a quantitative range, only the extreme positions require identification.

Example 2. A switch has three positions, for heat, defrost, and air conditioning. Since each position regulates a different function, each position must be identified.

S5.2.3 Any display located within the passenger compartment and listed in column 1 of Table 2 that has a symbol designated in column 4 of that

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table shall be identified by either the symbol designated in column 4 (or symbol substantially similar in form to that shown in column 4) or the word or abbreviation shown in column 3. Additional words or symbols may be used at the manufacturer's discretion for the purpose of clarity.

Any telltales used in conjunction with a gauge need not be identified. The identification required or permitted by this section shall be placed

on or adjacent to the display that it identifies. The identification of

any display shall, under the conditions of S6, be visible to the driver

and appear to the driver perceptually upright.

#### S5.3 Illumination.

S5.3.1 Except for foot-operated controls or hand-operated controls

mounted upon the floor, floor console, or steering column, or in the windshield header area, the identification required by S5.2.1 or

#### S5.2.2

of any control listed in column 1 of Table 1 and accompanied by the word

`yes' in the corresponding space in column 4 shall be capable of being

illuminated whenever the headlights are activated. However, control identification for a heating and air-conditioning system need not be illuminated if the system does not direct air directly upon windshield.

If a gauge is listed in column 1 of Table 2 and accompanied by the word

`yes' in column 5, then the gauge and its identification required by

S5.2.3 shall be illuminated whenever the ignition switch and/or the headlamps are activated. Controls, gauges, and their identifications need not be illuminated when the headlamps are being flashed. A telltale

shall not emit light except when identifying the malfunction or vehicle

condition for whose indication it is designed or during a bulb check upon vehicle starting.

S5.3.2. Each telltale shall be of the color shown in column 2 of Table 2. The identification of each telltale shall be in a color that contrasts with the background.

S5.3.3 (a) Means shall be provided for making controls, gauges, and the identification of those items visible to the driver under all driving conditions.

(b) The means for providing the required visibility--

(1) Shall be adjustable to provide at least two levels of brightness, one of which is barely discernible to a driver who has adapted to dark ambient roadway conditions.

(2) May be operable manually or automatically, and

(3) May have levels of brightness at which those items and identification are not visible.

(c) If the level of brightness is adjusted by automatic means to a point where those items or their identification are not visible to the driver, a means shall be provided to enable the driver to restore visibility.

S5.3.4 (a) Means shall be provided that are capable of making telltales and their identification visible to the driver under all

driving conditions.

(b) The means for providing the required visibility may be adjustable manually or automatically, except that the telltales and identification for brakes, highbeams, turn signals, and safety belts may not be adjustable under any driving condition to a level that is invisible.

S5.3.5 Any source of illumination within the passenger compartment which is forward of a transverse vertical plane 110 mm rearward of the manikin ``H'' point with the driver's seat in its rearmost driving position, which is not used for the controls and displays regulated by this standard, which is not a telltale, and which is capable of being illuminated while the vehicle is in motion, shall have either (1) light intensity which is manually or automatically adjustable to provide at least two levels of brightness, (2) a single intensity that is barely discernible to a driver who has adapted to dark ambient roadway conditions, or (3) a means of being turned off. This requirement does not apply to buses that are normally operated with the passenger compartment illuminated.

S5.4 A common space may be used to display messages from any sources, subject to the following requirements:

(a) The telltales for the brake, high beam, and turn signal, and the safety belt telltale required by S4.5.3.3 of Standard No. 208 may not be shown on the common space.

(b) Except as provided in S5.4(e), the telltales listed in Table 2 shall be displayed at the initiation of any underlying condition.

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(c) When the underlying condition exists for actuation of two or more messages, the messages shall be either--

(1) Repeated automatically in sequence, or  
(2) Indicated by visible means and capable of being selected by the driver for viewing.

(d) Messages may be cancellable automatically or by the driver.

(e) The safety belt telltale must be displayed and visible during the time specified in S7.3 of Standard No. 208.

S6. Conditions. The driver is restrained by the crash protection equipment installed in accordance with the requirements of Sec. 571.208

of this part (Standard No. 208), adjusted in accordance with the manufacturer's instructions.

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[GRAPHIC] [TIFF OMITTED] TR24SE98.032

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[GRAPHIC] [TIFF OMITTED] TR15MY00.000

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## Appendix F

### Applicable Underwriter Laboratories Standards Listing

Standard Number	UL Standard Title	Applicable to Section
UL 1642	Lithium Batteries	Section 3.2.1
UL 1585	Class 2 and 3 Transformers	Section 3.2.1
NFPA 70	National Electrical Code	General Electrical, may or may not require additional SAE or DOT requirements
UL 60950	Information Technology Equipment – Safety – Part 1: General Requirements	Section 3.2
UL 498	Attachment Plugs and Receptacles	Section 3.1.4.1
UL 1414	Capacitors and Suppressors for Radio and Television-Type Appliances	Section 3.1.4.1
NFPA 731	Standard for the Installation of electrical Premises Security Systems	Section 3.1.4.1
UL 817	Cord Sets and Power Supply Cords	Section 3.1.4.1
UL 1097	Double Insulation Systems for Use in Electrical Equipment	General Electrical
UL 507	Electric Fans	General Electrical
UL 1283	Electromagnetic Interference Filters	General Electrical
UL 62	Flexible Cord and Fixture Wire	General Electrical
UL 512	Fuseholders	General Electrical, may or may not require SAE specifications
UL 1446	Insulating Materials – General, Systems of	General Electrical
UL 1642	Lampholders, Edison-Base	General Electrical
UL 969	Marking and Labeling Systems	General Electrical
UL 94	Plastic Materials for Parts in Devices and Appliances, Tests for Flammability of	End Product
UL 746C	Polymeric Materials – Use in Electrical Equipment Evaluation	Polymeric Materials used in PCB's
UL 746F	Polymeric Materials – Flexible Dielectric Film Materials for Use in Printed-Wiring Boards and Flexible Materials	Mylar Film type material
UL 796	Printed Wiring Boards	General Requirements for PCB's (i.e. dielectric properties, single and multiple layer boards, etc.)
UL 1439	Sharpness of Edges on Equipment, Tests for	May be used to assist Section 3.1.1.3
UL 20	Switches, General-Use, Snap	General Electrical
UL 1054	Switches, Special-Use	General Electrical

UL 510	Tape, Polyvinyl Chloride, Polyethylene, and Rubber-Insulating	Additional Insulating Materials
UL 1059	Terminal Blocks	General Electrical
UL 1449	Transient Voltage Surge Suppressors	General Electrical
UL 224	Tubing, Extruded Insulating	General Electrical
UL 486A	Wire Connectors and Soldering Lugs for Use with Copper Conductors	General Electrical
UL 83	Wires and Cables, Thermoplastic-Insulated	General Electrical
UL 44		General Electrical
UL 6500	Audio/Video and Musical Instrument Apparatus for Household, Commercial, and Similar General Use	General Electrical
UL 3044	Surveillance Closed-Circuit Television Equipment	General Specifications
UL 2044	Surveillance Closed-Circuit Television Equipment	General Specifications



## Appendix G

### Digital Video Systems Advisory Panel Participants

The IACP wishes to acknowledge the contributions from representatives of the following agencies and companies. IACP endorsement of manufacturers listed is in no way implied.

A4S Security, Inc.	Florida Highway Patrol	National Transportation Safety Board
Applied Concepts, Inc.	Forensic Video Solutions	NL Technology
cMedia Solutions Company	IBM Global Services	New Albany, OH Police Department
Coban Research and Technologies, Inc.	ICOP Digital, Inc.	Northland Security Products
Chicago, IL Police Department	Integrian, Inc.	New York City, NY Police Department
Control Concepts, Inc.	Insight Video Net	On Patrol Video International
Cruise Cam International	Institute for Forensic Imaging	Panasonic Computer Solutions Company
Custody Video	International Police Technologies, Inc.	Prince Georges County, MD Police Department
Data 911	Kustom Signals, Inc.	Security Industry Association
Decatur Electronics, Inc.	L-3 Communications, Mobile-Vision	Sony Electronics, Inc.
Delaware State Police	Los Angeles, CA Police Department	Tarrant County, TX Criminal District Attorney's Office
Digital Ally, Inc.	Los Angeles County, CA Sheriff's Department	Underwriters Laboratories, Inc.
DriveCam Video Systems	McCoy's Law Line, Inc.	United States Park Police
EDO Corporation	Mobile Police Solutions	Verint Video Solutions
Enforcement Technologies International	Motorola, Inc.	Washington State Patrol
Everett, WA Police Department	MPH Industries, Inc	WatchGuard Video
Farmington, NM Police Department	National Institute of Standards and Technology	
Federal Bureau of Investigation	National Law Enforcement & Corrections Technology Center –West	
Fleet Safety, Inc.		